SECURE FISHERIES

Advancing Sustainable Fisheries

www.securefisheries.org

SECURING SOMALI FISHERIES

Sarah M. Glaser
Paige M. Roberts
Robert H. Mazurek
Kaija J. Hurlburt
Liza Kane-Hartnett

SECURE FISHERIES
Advancing Sustainable Fisheries

SECURING SOMALI FISHERIES

Sarah M. Glaser
Paige M. Roberts
Robert H. Mazurek
Kaija J. Hurlburt
Liza Kane-Hartnett

Contributors:
Ashley Wilson, Timothy Davies, and Robert Arthur (MRAG, London)

Graphics:
Timothy Schommer and Andrea Jovanovic

Please send comments and questions to:
Sarah M. Glaser, PhD
Research Associate, Secure Fisheries
One Earth Future Foundation
+1 720 214 4425
sglaser@securefisheries.org

Please cite this document as:
Glaser SM, Roberts PM, Mazurek RH, Hurlburt KJ, and Kane-Hartnett L (2015) Securing Somali Fisheries. Denver, CO: One Earth Future Foundation.
DOI: 10.18289/OEF.2015.001

Secure Fisheries is a program of the One Earth Future Foundation

one earth FUTURE

Cover Photo: *Shakila Sadik Hashim at Alla Aamin fishing company in Berbera, Jean-Pierre Larroque.*

TABLE OF CONTENTS

LIST OF FIGURES

**Province of China*

LIST OF TABLES

LIST OF BOXES

FOUNDER'S LETTER

In 2013, Somali representatives came together to visualize and create the Somali Maritime Resource and Security Strategy. This plan outlines many aspirations for a prosperous Somalia. The report herein honors a step towards that future.

The One Earth Future (OEF) foundation is proud to deliver *Securing Somali Fisheries*, the inaugural report of our Secure Fisheries program. This report closes previous gaps in knowledge about the state of Somali fisheries and documents the extent and impact of illegal, unreported, and unregulated fishing on Somalis and their fisheries resources. As the founder of OEF, I employ the skills that helped me build a successful business—analysis, evidence, foresight, and long-term thinking—to apply to global problems. As such, OEF conducts research and promotes ideas that lead to increased cooperation and conflict reduction. My hope is that the evidence presented by *Securing Somali Fisheries* will help catalyze the international fishing community, Somali fishing authorities, and NGOs to come together in their common interest to (1) strengthen fisheries management, (2) guide investment in fisheries resources, and (3) improve monitoring, control, and surveillance efforts in Somali waters.

Two years ago, several European Union countries, the United States, the World Bank, the African Development Bank, and others pledged €1.8 billion towards peace and state-building efforts in Somalia (the Somali New Deal Compact). Revitalizing and expanding the Somali economy is a central component of these efforts. Fisheries is one of three high-priority economic sectors targeted for growth. If developed sustainably with an eye towards building long-term prosperity, Somali fisheries will provide jobs and economic opportunity in many under-served communities.

Today, Somali fisheries face numerous challenges. Decades of unregulated fishing by foreign vessels and a severe lack of fisheries management have taken their toll. This report shows that foreign vessels from over a dozen different countries catch many times more fish than Somalis do every year. This unregulated foreign fishing risks depleting a resource that should promote food and economic security for Somalis. Rampant bottom-trawling also causes substantial damage to important coastal ecosystems that are needed to sustain local fisheries. Conversely, if foreign vessels were regulated by their governments and properly licensed and monitored, Somalia and Somaliland could invest license fees to build domestic fisheries and processing activities. Eventually, foreign vessels could land their regulated catch in Somalia, providing much-needed revenue as seafood products move up the value chain. Further, growth of the domestic fishing sector will benefit from a long-term approach to development that balances short-term needs with longer-term economic goals. This will ensure fishing is developed around a resource base that will provide a reliable source of income for generations to come, rather than around one that will be depleted.

To achieve this combination of economic development and resource security, foreign fishing must be limited in order to promote a vibrant domestic fishing economy. Domestic fishery laws must translate into effective management plans promoting sustainability and prioritizing the livelihoods of Somalis. This report offers key recommendations to help achieve these ends and secure prosperous and sustainable fisheries for Somalia.

These steps can contribute to lasting stability in Somalia. Given the potential for a rebound in piracy and the ongoing threat from Al-Shabaab, improved security in this region is of vital importance to the EU, the US, and the international community.

Secure Fisheries was developed as part of Oceans Beyond Piracy's work to facilitate public-private partnerships and promote maritime governance and security. They, along with Shuraako, our Somali finance and business development program, are funded by the One Earth Future Foundation.

Marcel Arsenault

Founder and Chairman, One Earth Future Foundation

ACKNOWLEDGEMENTS

This report benefitted substantially from the input of many individuals within One Earth Future, in Somalia, and in the international community.

Secure Fisheries was developed as part of Oceans Beyond Piracy's work to facilitate public-private partnerships and promote maritime governance and security. Input for this report came from Jon Huggins, Jerome Michelet, Jens Vestergaard Madsen, John Steed, Matthew Walje, Ben Lawellin, and Peter Kerins. We had significant assistance from Shuraako members Abdikarim Gole and Mahad Awale who distributed our survey of Somali fishers and gave us valuable advice. We also had support from Lee Sorensen, Alex Wise, John Linton, and the entire Shuraako team.

We are indebted to many Somalis who provided photographs, stories, and information about their lives as fishers to guide some of our reporting. In particular, we thank Yusuf Abdilahi Gulled Ahmed and Jama Mohamud Ali for their advice. We are incredibly grateful for expert feedback and input from people who have lived and worked in Somalia and the region, including Julien Million, Andy Read, Marcel Kroese, Per Erik Bergh, Jorge Torrens, Kifle Hagos, and Stephen Akester.

Timothy Davies, Ashley Wilson, and Robert Arthur of MRAG collected and analyzed price data, created value chain diagrams, estimated the value of Somali fisheries presented in Chapter 3, estimated the potential license fee revenue in Chapter 2, and wrote a significant portion of Chapter 3. We received valuable comments on early drafts of this report from Julien Million, Dyhia Belhabib, Stephen Akester, Rashid Sumaila, and Steve Trent. Technical advice was provided by Dirk Zeller, Christopher Costello, and Daniel Ovando.

Graphics and layout are compliments of Tim Schommer and Andrea Jovanovic. Administrative support was provided by Laura Burroughs. Photography and video creative support by Jean-Pierre Larroque. Web design and support by Tim Schommer and Michael Stadulis.

We are extremely grateful to our data partners. exactEarth provided a significant amount of satellite Automatic Identification System data. The Sea Around Us at the University of British Columbia, including Dirk Zeller, Dyhia Belhabib, Kyrstn Zylich, and Deng Palomares, provided the domestic catch data reconstructions used throughout the report. The U.S. National Marine Fisheries Service of the National Oceanic and Atmospheric Administration, particularly Michael Fogarty, provided output from model runs of their fishery production potential model for Somali waters. Andy Hickman provided valuable data, photographs, and interviews that were invaluable to our estimates of foreign fishing.

DEDICATION

This report is dedicated to the memories of Jorge Torrens and Yahye Osman. Jorge and Yahye worked for the UN Food and Agriculture Organization fisheries sector. Tragically, they lost their lives in a car accident in Somaliland on April 29, 2015. Jorge joined FAO in 2010 and worked as a fisheries officer in Mauritania, Kenya, and Somalia. Yahye joined FAO in 2009 and worked as a driver in Somalia; he had recently been promoted to the fisheries technical team. Both men were dedicated to and loved their work in Somali fisheries. Jorge was an early contributor to this report. Our thoughts and prayers are with their colleagues, family, and friends.

DULMAR KOOBAN OO KU SAABSAN MAAMULKA FULINTA (EXECUTIVE SUMMARY - SOMALI)

Biyaha Soomaaliya waxa ku jira khayraad lexaad leh oo gacan weyn ka gaysan kara wax soo saarka kalluumaysiga dunida. Hase ahaatee, waaxda kalluumaysiga maxalliga ah ee Soomaaliya ilaa iyo hadda aad buu u yar yahay. Horumarkii ay samaysay waaxda kalluumaysiga maxalliga ah ee Soomaaliya intii u dhaxaysay 1970-yadii iyo 1990-yadii ayaa lagu tilmaami karaa mid miro-dhal ahaa, laakiin wixii ka dambeeyey sanandkii 1991, dagaalladii sokeeye ee dalka ka dhacay ayaa dib-u-dhac u gaystay horumarinkaas, kaasoo albaabbada u furay in ay biyaha Soomaaliya soo wajahaan mawajado kalluumaysi sharci-darro ah oo ay gaysanayeen maraakiib shisheeye. Inkastoo si aad u liidata loo aqoonsan yahay xaaladda kalluumaysatada Soomaaliya, haddana waxaa hadda socota danayn aan sidaas u weynayn oo ay ku hawlan yihiin; bulshada maxalliga ah, khubaro iyo maalgashadeyaal shisheeye, taasoo diiradda lagu saarayo baahida fahamka xaaladda kalluumaysiga biyaha dalka Soomaaliya.

Waxay warbixintani abuurtay farqi aad isugu dhow oo looga fa'iisdaysan karo aqoonta kalluumaysiga Soomaaliya ee ay ka mid yihiin:

- Heerka/baaxadda uu gaarsiisan yahay kallumaysiga shiseeye;
- Mudnaanta taabbagelinta xaaladda dhaqaale ee noocyada khayraadka ee ku jira;
- U-Nuglaanshaha kalluumaysiga xad-dhaafka ah ee biyaha Soomaaliya; iyo
- Qiimaha dhaqaale iyo baaxadda silsilladda beec-geynta wax-soo-saarka ee suuqayada maxalliga ah.

Waxay warbixintani sare u qaadaysaa taabbagelinta xaddiga kalluumaysiga Soomaaliya, sida lagu xaqiijinayo; xogta khayraadka aan laga faa'iidaysan, iftiiminta caqabadaha jira, iyo isku-xirka dadaallada socda. Waxa kaloo ay warbixintu tilmaamo ka bixinaysaa asaaska kobcinta iskaashiga dadka ku hawlan kalluumaysiga, is-dhaafsiga xogta, iyo in laga wada dhex muuqdo hawgalka. Ugu dambayntii, waxay warbixintu ugu baaqaysaa beesha caalamku inay mudnaan siiso hufnaanta kallumaysiga Soomaaliya iyo xaqiijinta in maraakiibtooda kalluumaysigu ay u hoggaansamaan sharciga Soomaaliya, si loo xoojiyo shaqo abuurka, kobcinta iyo taabbagelinta waaxda kalluumaysiga Soomaaliya.

Warbixinteennu waxay muujinaysaa in dhibaatada ugu weyn ay tahay sharci-darrada, nidaam la'aanta iyo u-warbixin la'aanta (IUU) ee kalluumaysiga, taasoo cabsi ku abuuri karta hufnaanta kalluumaysiga Soomaaliya. Waxaan ku qiyaasi karnaa kalluumaysiga maraakiibta shisheeye ee IUU inay saddex goor ka badan yihiin xaddiga waaxda baaxadda yar ee kalluumaysatada Soomaaliya, iyadoo intooda badan maraakiibtaasi ay waxyeello lexaad leh u gaystaan deegaanka. Sidaasi darteed, waxay daraasaddayadu soo jeedinaysaa in marakiibta shisheeye si deg deg ah loo xaddido tiro ahaan, la nidaamiyo, si joogto ah looga warbixiyo, iyo in ruqsado ama shati loo sameeyo. Waxa kaloo aan ogaannay in kalluumaysto badan oo Soomaaliyeed ay u kalluumaystaan si aan taabbagal ahayn oo haddii uu qaabkaasi sii socdo ay kalluumaysatadu soo wajehi doonto hoos-u-dhac dhinacyada xaddiga kalluumaysiga iyo faa'iidada ay helayaanba.

Cutubka 1aad: Hordhaca Kalluumaysiga Badaha Soomaaliya

Cutubka 1aad, waxaan dib-u-eegaynaa dulmar kooban oo taariikhda Soomaaliya iyo waayeheeda kalluumaysiga ah. Iyadoo aan tira-koobyada heer-qaran dib-loo-cusboonaysiinin ayaa xogta tirada dhowaanahan la hayo lagu diiwaangeliyey 4,500 oo kalluumaysato waqti-buuxa ah iyo 5,000 oo kalluumaysato waqti-dhiman ah gobolka oo dhan. Sannadkii 1996, kalluumaysigu waxa uu si dadban u shaqaaleeyey 30,000 qof oo dheeraad ah oo waqti-buuxa ah iyo 60,000 oo qof oo waqti-dhiman ah oo ka shaqanayey sida; dayactirka farsamada, silsilladda qaboojiyeyaasha wax-soo-saarka, iyo habaynta/warshadaynta. Waxaa mudnaan weyn la siiyey xirfadleyda habaynta noocyada kala duwan ee kalluunka, cusbaynta aargoosatada, shirimbiska, libaax-badeedka iyo kaydinta tamarta tayo-gelinta wax-soo-saarka. Kalluumaysatada gobollada kala duwan waxaa la soo gudboonaaday caqabado waaweyn oo dhinaca horumarinta liddi ku ah, waxaana ka mid ah; kaabayaal la'aan, aqoon-yari, baraf, qaboojiyeyaal, iyo agabka keydinta qaboojinta, kuwaasoo ka mid ah caqabadaha ugu waaweyn ee hortaagan ballaarinta waaxda kallumaysiga dalka.

Tobannaan sano kaddib waxaa la dhisay maamulka kalluumaysiga deg-degta ah, kaasoo dhowaan ku guulaysatay dhawr tallaabo oo muhiim ah:

- Bishii April 2014, waxaa heshiis wada gaaray wakiillo ka kala socday Dowladda Federaalka Soomaaliya (DFS), Somaliland, Puntland, Jubaland, iyo Galmudug si ay isaga kashadaan maaraynta kalluumaysiga iyadoo loo sii marayo hab-raacyada ruqsadaha federaaliga ah ee ku wajahan noocyada kalluunka ee xawliga ku socdaalaya (HMS) iyo ruqsadaha xeebleyda heer gobolka iyo noocyada kalluunka gaarka ah.
- Bishii May 2014, Soomaaliya waxay ku biirtay Golaha nooca Tuna ee Badweynta Hindiya (IOTC) iyadoo ay beesha caalamku gacan ka gaysanayso sidii la isaga kaashan lahaa maaraynta Tunada iyo noocyada Tunada la midka ah.
- Bishii June 2014, Soomaaliya waxay si cad ugu dhawaaqday Aagga Dhaqaale ee gaarka biyaheeda badda u gaarka ah (EEZ), xoojinta asaaska sharcigeeda ee maaraynta kalluumaysiga, gaar ahaanna, inay xurmeeyaan maraakiibta shisheeye ee biyaha Soomaaliya.
- Bishii Oktoober 2014, baarlamaanku wuxuu dhaqan-geliyey sharciga dib-u-cusboonaysiinta qabyada ah ee kalluumaysiga, sharciga Kalluumaysiga Soomaaliya (Sharci Lo29), kaasoo uu saxiixay madaxweyne Xasan Sheekh Maxamuud bishii November 2014. Wuxuu sharcigani mudnaan siinayaa taabbagelinta, sare u qaadista iskaashiga u dhexeeya DFS iyo maamul goboleedyada, aqoonsiga muhiimadaha ay ka mid yihiin; fikradaha maaraynta kalluumaysiga, iyo in mawqif adag oo ka dhan ah kalluumaysiga sharci-darrada ah (IUU) oo lagu tallaabsado.

Cutubka 2aad: Kalluumaysiga Shisheeye ee Biyaha Soomaaliya

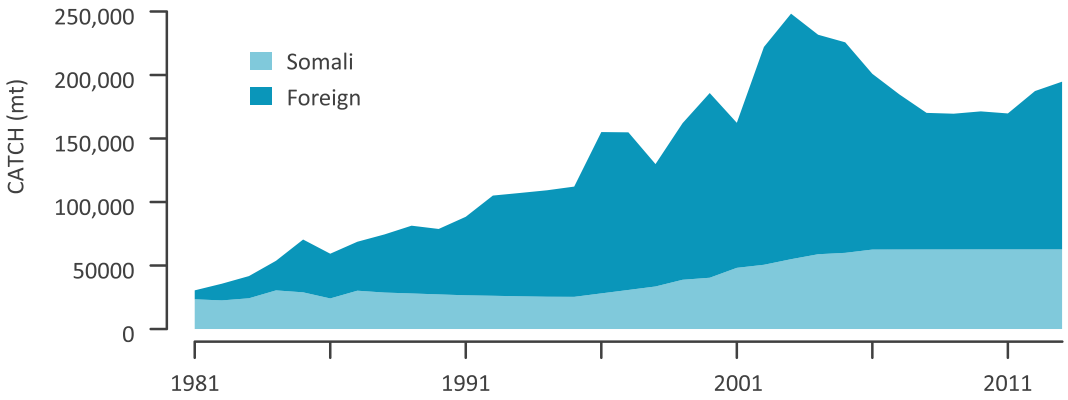
Cutubka 2aad, waxaynu samaynay dib-u-eegistii ugu horraysay oo baahsan iyo sidii loo cabbiri lahaa kalluumaysiga shisheeye ee biyaha Soomaaliya. Sidaasi darteed, waxaa la daabacay warbixinno isku-dhafan oo ka kala yimid waraysiyo lala yeeshay khubaro, daraasado xogta dayac-gacmeeyada ah, iyo warbixinta xogta xaddiga jillaabashada, waxaana qiyaasnay in maraakiibta shisheeye ee xilligan ay kalluumaystaan in ka badan 132,000 mt sannadkiiba xilli-badeedka, taasoo ugu yaraan saddex goor ka badan xaddiga heer-nololeedka ee jillaabashada maxalliga ah. Sida dhammaan la wada sheegay, waxaan ku qiyaasnay maraakiibta shisheeye inay jillaabteen in ka badan 3 million mt oo kalluun ah ilaa 1981. Iran iyo Yemen ayaa noqday kuwa ugu ballaaran ee ka kalluumaysta biyaha Soomaaliya, waxayna shabakadaha maraakiibtoodu bartilmaameed ka dhigteen noocyada Tunada ee xawaaraha socdaalka ugu sarreeya iyo kaluumaysiga xeebleyda. Waxaa kaloo ka mid ah marakiibta raxanta ah iyo maraakiibta fidsan ee qaaradaha Yurub iyo Aasiya ka yimid oo si baahsan ugu sugan biyaha Soomaaliya, kuwaasoo bartilmaameedkoodu yahay; nocyada muhiimka ah ee skipjack, yellow fin tuna, billfishes, iyo libaax-badeedka. Dhinaca kale, jillaabashada rasmiga ah ee shiinaha ayaa la sheegay inay yar tahay, taasoo la oran karo inay salka ku hayso maraakiibta Shiinaha ee masaafada dheer ku socota waxaana amuurtan lagu saleeyey nidaam aan xog sugan lahayn, iyadoo la tuhunsan yahay in jillaabashadu intaas ka sarrayso. Raxanno maraakiib yar yar ah iyo kuwa kallumaysiga ee waaweynba wey ka buuxaan xudduudaha ka baxsan biyaha Soomaaliya EEZ, halka kuwa kalena la siiyey ruqsado ay kaga kalluumaystaan gudaha aagga dhaqaalaha ee u gaarka ah Soomaaliya (EEZ).

Kalluumaysiga sharci-darrada ah ee biyaha Soomaaliya (IUU) wuxuu ahaa dhibaato soo socotay ilaa tobannaan sano. Intii lagu jiray sannadihii 1990-yadii kalluumaysiga sharci-darrada ah (IUU) wuxuu noqday cudur-daar in looga dhigto burcad-badeed weeraraysa marakiibta shisheeye. Intaas waxaa dheer, taabbagelinta horumarinta kalluumaysiga Soomaaliya waxaa hortaagan xad-gudubyada maraakiibta shisheeye ee ka jillaabta Soomaaliya (IUU). Intaas waxaa soo raaca, xad-gudubyada baahsan ee aan xogta laga haynin, kalluumaysiga shisheeye ee aan nidaamka lahayn, ha ahaato sharci-darro ama yeysan ahaanine, waxay abuurtay caro dadweyne. Waxa maraakiibta shisheeye lagu eedeeyey inay kiraystaan dabley hubaysan oo rasaas ku fura Soomaalida, kuna sayraan/weeraraan biyo kulul Soomaalida, burburiyaan doonyaha kalluumaysiga yar-yar, qiimahana ku jebiyaan/raqiisiyaan ganacsiga jillaabashada suuqyada maxalliga ah, iyagoo waxyeelleeya goobaha deegaanka kallumaysatada. Maamullada Soomaaliya ayaa waxay beesha caalamka ka codasdeen in gacan laga siiyo dagaalka ka dhanka ah kalluumaysiga sharci-darrada ah. Bishii April 2015, wafdigii ka qaybgalay shir-sannadeedka (IOTC) ayaa soo bandhigay dhacdooyin gaar ah oo qeexayey xaddiga kalluumaysiga maraakiibta shisheeye, waxaana lagama maarman noqotay in hoos loo dhigo kalluumaysiga sharci-darrada ah ee maraakiibta shisheeye (IUU) ee biyaha Soomaaliya, taasoo noqotay mudnaan deg-deg ah, waana arrin xilligan xasaasi ah oo ay beesha caalamku garowsatay in tallaabo laga qaado.

Joogitaanka maraakiibta shisheeye waxay saamayn xun ku yeelan kartaa xaaladda deegaanka. Waxaan u isticmaalnay sahan dayac-gacmeed ah toddobo maraakiibta Kuuriya ah si loo qiyaaso waxyeellada ay gaarsiin karaan gunta hoose ee badaha Soomaaaliya. Maraakiibta gunta hoose ka jillaabta waxay si baahsan uga kalluumaystaan qiyaastii 75% sannadka oo dhan, waxayna bartilmaameedsadaan moolka hoose ee biyaha oo ay ka xaalufiyaan kalluunka. Maraakiibta gunta hoose beegsata waxay dabar-gooyaan noocyada kalluunka, iyagoo deegaankana waxyeello weyn gaarsiiya, hoosna u dhiga kala duwanaanshaha bay'adda, islamarkaana yareeya tirda kalluunka biyaha ku jira. Waxaan ku qiyaasnay dhulka la xaalufiyey in ka badan 6000 mt oo kalluun ah sannad kasta, laakiin waxa laga yaaba in ay dhimashada kalluunku intaas ka sarrayso marka loo eego jillaabashada. Intaas waxaa dheer in tirada maraakiibta ah ee gunta hoose ka jillaabata ay ka badan yihiin kuwa aan sahaminnay, islamarkaana ay leeyihiin saamayn aan wanaagsanayn oo ay maraakiibtaasi gaystaan, taasoo aad uga ballaaran xogta aynu heli karno. Sidaas awgeed, waxaan soo jeedinaynaa in si deg-deg a looga joojiyo maraakiibta xaalufisa gunta hoose ee biyaha badda Soomaaliya, taasoo waafaqsan sharciga cusub ee kalluumaysiga Soomaaliya.

Si kastaba ha ahaatee, joogitaanka qaar ka mid ah maraakiibta shisheeye waxaa laga yaabaa inay Soomaalida fa'iidooyin u leeyihiin. Waxanan ku qiyaasnay inay Soomaalida uga soo xarooto inta u dhaxaysa US$4 iyo US$17 million dakhli ah sannad kasta oo ay ka helaan ruqsadaha maraakiibta waaweyn iyo raxanta maraakiibta ka jillaabata nooca Tunada biyaha Soomaaliya. Dakhliga ruqsaduhuna intaas waa uu ka badan lahaa haddii ruqsado la siin lahaa maraakiibta jillaabashada ee Iran iyo Yemen. Dakhligani wuxuu gacan buuxda ka gaystaa fursadaha maalgelinta ee waaxda kalluumaysiga Soomaaliya. Si loo fududeeyo taabbagelinta horumarinta kalluumaysiga Soomaaliya, waxaa lagama maarman ah in la xaddido kalluumaysiga shisheeye, (sharci ha ahaadeen ama yeysan ahaanine), islamrkaana waa in ruqsad la siiyaa, la diiwaangeliyaa, loona sameeyaa xeerar iyo nidaam sida ugu dhakhsiyaha badan.

Qiyaasta Jillaabashada ee shisheeye iyo maraakiibta kalluumaysiga Soomaaliya, 1981–2013.



Cutubka 3aad. Qiimaha Dhaqaale ee Kalluumaysiga Maxalliga ah ee Soomaaliya

Cutubka 3aad, waxaan daraasad ku samaynay silsilladda qiimaha maxalliga ah ee wax soo saarka kalluunka. Qaab-dhismeedka badeecadaha kalluumaysiga maxalliga ah ee ay soo jillaabtaan maraakiibta maxalliga ah ayaa muujinaya fursado muhiim ah oo dhinaca kororka horumarinta iyo isticmaalka badeecaddan ee gudaha Soomaaliya iyo u dhoofinta dibaddaba. Jillaabashada kalluunka Soomaaliya ayaa si weyn u kordhay marka laga soo billaabo bartamihii 1980-yadii ilaa maanta, laakin suuq-gayntu wax is-beddel ah oo muuqda ma aanay samaynin. Waxaan horumarinnay qiimaha silsilladda ee noocyada kala ah; finfishes, libaax-badeedka iyo aargoostada si loo soo bandhigo muhiimadda horumarinta suuq-gaynta wax soo sarka kalluunka Soomaaliya.

Waxaan ku qiyaasnaa wadarta qiimaha dhaqaale ee kalluumaysiga maxalliga ah, kaddib marka lagu daro kharajyada silsilladda qaybinta badeecadaha, ilaa US$135 million sannadkiiba. Waxaana tixgelin mudan faa'iidada dhaqaale ee laga helo kalluumaysiga Soomaaliya iyo cunto-badeedka marka lagu daro kharajyada ku baxa adeegyada kale. Goobaha laga soo

dejiyo kalluunku ma ahan kuwo qalabaysan, mana laha adeegyo ku filan habaynta kalluunka sida makaanikada, barafka, gaadiidka, iyo badbaadada qalabka waxaana jira walaac haysta kaabayaashasha, keydinta iyo rarista kalluunka. Natiijadu waxay noqotay in kalluumaysatada Soomaalidu aysan ka faa'iidaysan qiimaha tayada leh ee laga heli karo habaynta kalluunka. Horumarinta adeegyada habaynta ee mashaariicda yar-yar, waxay awood u siin karaan kalluumaysatada kobcinta xirfadaha jillaabashada iyagoo sare u qaadi kara hab-raacyada fursadaha suuq-gaynta wax soo saarkooda.

Markii aan la sheekaysannay kalluumaysatada Soomaaliyeed, ayaa waxaa noo muuqatay koror muhiim ah oo tilmaamaya xaaladda khayraadka, iyadoo faa'iidada ka luntay ay horseedday tartan ka imaanaya maraakiibta shisheeye ee warshadaha leh, iyagoon fursad u helin suuqyada rasmiga ah. Haddii si isu-dheellitiran loo horumariyo, wuxuu kalluumaysigu yeelan karaa fursado muhiim ah oo lagu horumarin karo wax soo saarka cuntada, badbaadada dakhliga iyo ugu dambayntii deggenaansho dhaqaale.

Cutubka 4aad: Taabbagelinta Kalluumaysiga Biyaha Soomaaliya

Cutubka 4aad, waxaan daraasad ku samaynay taabbagelinta wax soo saarka kalluunka biyaha Soomaaliya. Waxaan helnay 8 ka mid ah 18 kooxood oo kalluun ah oo hadda la kalluumaysto oo aan gaarsiisnayn heer taabbagal ah sida; (swordfish, striped marlin, emperors, goatfish, snappers, libaax-badeed, groupers, iyo grunts). Kooxaha kale ee kalluun ee aan weli daraasad buuxda lagu samayn, waxaa ka mid ah; (bigeye, skipjack, sayn-dheere iyo yellowfin tuna, blue marlin, dolphinfish, jacks, clupeids (sardines), iyo rays) waxayna u muuqdaan inay taabagal noqon karaan waqtigan la joogo.

Intaas waxaa dheer, waxaan celcelis ku samaynay tirada kalluunka ee taabbagalka ka noqon kara jillaabashada biyaha Soomaaliya, taasoo loo yaqaanno wax soo saarka xayiga ah ee kalluunka (FPP), annagoo is-bar-bar-dhignay tirada kalluunka ee hadda laga soo jillaabto biyaha Soomaaliya. FPP waxaa lagu qiyaasaa isticmaalka habka horumarinta ee hay'adda Cuntada & Beeraha (FAO). Is-bar-bar-dhiggeennu wuxuu soo bandhigayaa gumaadayaasha ugu sarreeya ee khayraadka badda (macne ahaan… piscivores sida nooca tuna iyo Libaax-badeedka) ee la soo jillaabto xaddiga ugu sarreeya mana jiraan fursado lagu taabbagelin karo kordhinta jillaabashada kalluunkan. Hase yeeshee, Jillaabashada kalluunka (macne ahaan; planktivores sida nooca sardines iyo anchovies) ee kalluunka gunta hoose uu suurtgelin karo jillaabasho heer sare ah ee mustaqbalka. Si loogu guulaysto taabbagelinta horumarinta, waxaan soo jeedinaynaa tallaabooyin fara badan oo jillaabashada noocyada kalluunka gunta hoose ku jira ah, laguna yarayn karo gumaadka khayraadka badda lagu hayo.

Ugu dambayntii, waxaa muuqata rajo weyn oo lagu taabbagelin karo kalluumaysiga Soomaaliya. Celcelis ahaan, kalluumaysigu waa ka taabbagal wanaagsan yahay qaybaha kale ee wax soo saarka cunnooyinka kale ee dunida, waana muhiim in la qaado tallaabooyin deg-deg ah oo lagu maaraynayo barbaadinta taabbagelinta kalluumaysiga. Hase yeeshee, taxaddar dheeraad ah ayaa loo baahan yahay. Haddii ay sii socoto jillaabashada xad-dhaafka ah ee qaabka hadda socdo waxaan qiyaasi karnaa in ka badan nus khayraadkaas ka mid ah in uu ku dhammaan doono heerar aan taabagal ahayn muddo toban sano ah ku siman.

Cutubka 5aad: Fursadaha lagu horumarin karo Kalluumaysiga Biyaha Soomaaliya

Kalluumaysiga Soomaaliya, waxa uu leeyahay hodantinnimo waafi ah, laakin haddana waxaa kaloo jirta khatar aad u weyn. Xawliga jillaabashada kallumaysatada shisheeye oo intooda badan sharci-darro ah ayaa ka mid ah caqabaha ugu waaweyn ee walwalka waqtiga dheer ku haya caafimaadka deegaanka kalluumaysatada Soomaaliyeed iyo dhaqalalahaba.

Cutubka 5aad, waxaan ku tilmaamaynaa sagaal iyo toban fursadood oo lagu taageeri karo taabbagelinta asaaska kalluumaysiga Soomaaliya, iyadoo Soomaliduna ay ku yarayn karto kalluumaysiga sharci-darrada ah ee biyaha Soomaaliya islamarkaana ay beesha caalamku tallaabo ka qaaddo joojinta sharci-darrada iyo bur-burinta goobaha kalluumaysiga Soomaaliya. Qaar ka mid ah fursadaha muhiimka ah waxaa ka mid ah:

- Dhammaystirka nidaaamka ruqsad-siinta maraakiibta shisheeye; iyadoo dakhligaasna lagu maalgelinayo waaxda

kalluumaysiga Soomaaliya;

- In horumarin baaxad leh lagu sameeyo baaritaanka xad-gudubyada jira, iyadoo la adeegsanayo dabagal, la-socosho, xakamayn iyo kormeerid joogto ah;
- In la kordhiyo ururinat xogta;
- In lagu horumariyo waaxda maxalliga ah adeegsiga maalgelinta agabka qaboojiyeyaasha iyo kaabayaasha dhaqaale;
- Horumarinta qorashayaasha maaraynta kalluumaysiga;
- Joojinya kalluumaysiga sharci-darrada ah ee shisheeye, iyadoo lagu soo rogayo cunaqabatayn maraakiibtaas ka dhan ah;
- In la hagaajiyo xog is-dhafsiga u dhaxaysa maraakiibta ciidammada badda, kuwa kalluumaysiga iyo mas'uuliyiinta Soomaaliya;
- In koormeer joogto ah lagu sameeyo maraakiibta looga shakiyo inay kalluumaysi sharci-darro ah biyaha Soomaaliya ka wadaan; iyo
- In la taageero heshiisyada heer gobol ; si loo soo af-jaro kalluumaysiga sharci-darrada ah (IUU).

Gunaanad/Gebegebo

Ugu dambayntii, kalluumaysiga Soomaaliya wuxuu awood buuxda u leeyahy inuu kobciyo cuntada iyo badbaadinta dakhliga gobolka oo dhan. Wax soo saarka tayada leh ee kalluumaysatada maxalliga ah ayaa wuxuu sare u qaadi karaa shaqo abuurka iyo dhaqaalaha bulshada, islamarkaana waa qaybta ugu ballaaran ee dalka Soomaliya ee fursado hawl-gelin iyo dhiiregelinba ay ka heli karaan waaxyaha shaqaalaha tabaalaysan. In ka badan labaatan sano ayey maraakiibta shisheeye si sharci-darro ah uga kalluumaysanayeen biyaha Soomaaliya (IUU), iyadoo ay bar-bar socotay dadaallada beesha caalamka ee ay ku taageeraysay maalgelinta, xeer-u-samaynta maaraakiibtooda, iyo dhawrista shuruucda dalka Soomaaliya. Marka loo eego xeerarka maalgashiga dhaqaalaha kalluumaysiga, gaar ahaanna, kaabayaasha dhaqaalaha, ayaa waxa laga dareemayaa hoos u dhac inuu ku yimid; iyadoo la horumarinayo waaxyaha kale ee maxalliga ah ayaa waxa jaangooyo lagu sameeyey taabbagelinta asaaska waqtiga fog iyo dib-u-habaynta Amniga qaranka.

EXECUTIVE SUMMARY - ENGLISH

Somali waters have the potential to support some of the most productive fisheries in the world. Yet, the domestic fishing sector in Somalia is relatively small. Development of fisheries proceeded fruitfully during the 1970s and 1980s, but the 1991 civil war reversed this development and opened Somali waters to an influx of unregulated fishing from foreign vessels. Although Somali fisheries are poorly documented, a recent surge in interest from investors has highlighted the need to understand the state of Somali fisheries.

This report was created to close the significant gaps in knowledge of Somali fisheries, such as:

- The magnitude of foreign fishing;
- The effects of illegal foreign fishing on Somali fisheries and supporting habitat;
- The sustainability status of economically important species; and
- The economic value and supply chain potential of domestic markets.

This report promotes sustainable harvests of Somali fisheries by identifying underused resources and highlighting challenges. By creating a shared set of knowledge about the resource, it also provides a foundation for improved stakeholder partnerships, data sharing, and transparency. Finally, the report calls on the international community to prioritize the health of Somali fisheries and ensure that their fishing vessels follow Somali law in order to promote jobs, growth, and stability.

Our report shows that the biggest cause for concern is foreign illegal, unregulated, and unreported (IUU) fishing. We estimate foreign IUU vessels catch three times as many fish as the Somali artisanal fishing sector, and many of those vessels cause significant environmental damage. Our analysis suggests that foreign fishing must immediately be limited, regulated, reported, and licensed. We also find a significant number of Somali fish stocks are overfished and, if these trends continue, Somali fishers will face declining catches and profits.

Chapter 1: Introduction to Somali Marine Fisheries

In Chapter 1, we review a brief history of Somalia as it relates to its fisheries sectors. While national-level statistics are outdated, the most recent numbers available document 4,500 full-time and 5,000 part-time fishers across the region. In 1996, fisheries indirectly employed an additional 30,000 persons full-time and 60,000 part-time in occupations. Fisheries in all regions face significant challenges to development. The lack of infrastructure, especially ice, freezing, and cold storage facilities, is a major constraint on the expansion of fisheries.

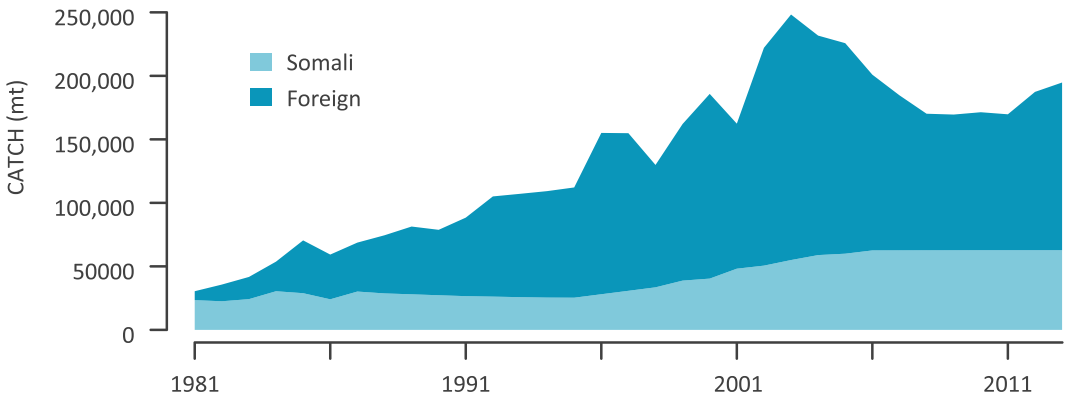
After decades of limited fisheries management, several important steps have been made recently:

- In April 2014, Somali representatives agreed to cooperate on fisheries management through federal and regional licensing schemes.
- In May 2014, Somalia joined the Indian Ocean Tuna Commission and engaged the international community in shared management of tuna and tuna-like species.
- In June 2014, Somalia proclaimed its Exclusive Economic Zone, strengthening its legal foundation for fisheries management, especially with respect to foreign vessels in Somali waters.
- In October 2014, the parliament adopted an updated draft fisheries legislation, the Somali Fisheries Law (Law n°29), which was signed by President Hassan Sheikh Mohamud in November 2014. This legislation prioritizes sustainability, promotes cooperation between federal and regional administrations, recognizes the importance of including fishers' perspectives in fisheries management, and takes a strong stand against IUU fishing.

Chapter 2: Foreign Fishing in Somali Waters

In Chapter 2, we report the results of the first comprehensive review and measurement of foreign fishing in Somali waters. We combine published reports, interviews with experts, analysis of satellite data, and reported catch data to estimate total catch by foreign vessels. Foreign vessels caught over 132,000 metric tons of marine life in 2013, nearly three times the amount caught by Somali artisanal and subsistence fishers. Iran and Yemen have the largest fishing presence in Somali waters. Vessels from Europe and Asia also have had a significant presence in Somali waters. Many of the foreign purse seine and longline vessels crowd the outside border of the Somali Exclusive Economic Zone, while others have been granted license to fish inside the EEZ.

Estimated catch by foreign vessels and Somali vessels in Somali waters, 1981–2013.



IUU foreign fishing in Somali waters has been a problem for decades. During the 1990s, IUU fishing became an initial justification for pirate attacks on foreign fishing vessels. The sustainable development of fisheries by Somalis is made significantly more difficult while foreign IUU vessels operate with impunity. Furthermore, rampant unreported and unregulated foreign fishing, whether illegal or not, has galvanized public resentment. Foreign vessels have been accused of hiring armed guards and shooting at Somalis, spraying Somalis with hot water, destroying artisanal fishing gear, depleting fish stocks at the expense of domestic catch, and destroying coral reef habitat. Somali authorities have asked for international cooperation to fight back against illegal foreign fishing. It is imperative to reduce foreign IUU fishing in Somali waters, and now is a critical time for the international community to act.

The presence of foreign fleets also damages habitat. Bottom trawlers, vessels that drag nets along the seafloor in shallow waters, are active in Somali waters during 75% of the year. Bottom trawling wreaks havoc on marine habitat, reduces biodiversity, and diminishes fish populations long after trawling ceases. Furthermore, the number of active trawlers is higher than what we tracked, and the negative impact of trawling is much greater than we can document. As such, we recommend that bottom trawlers cease operating in Somali waters immediately, in line with Somalia's new fisheries legislation.

However, the presence of some foreign vessels could be leveraged for the benefit of Somalis. We estimate Somalis could generate between US$4 and US$17 million in revenues each year from licensing foreign longline and purse seine tuna fleets. Licensing revenue would be even greater if vessels from Iran and Yemen were licensed. This potential revenue represents an important opportunity for investment in the Somali fisheries sector. To facilitate the sustainable development of Somali fisheries, foreign fishing (both legal and illegal) must be limited, licensed, recorded, and regulated as soon as possible.

Chapter 3: Economic Value of Somali Domestic Fisheries

In Chapter 3, we analyze domestic value chains for fish products. The market for fish products that are landed by Somalis shows significant opportunity for growth and development, both within Somalia and for export. Somali fish catch increased dramatically from the mid-1980s to today, but markets did not concurrently diversify. We develop value chains to demonstrate the potential for market development of Somali fish products.

We estimate the total economic value of domestic fisheries, after value is added through the supply chain, to be US$135 million per year. Substantially greater economic benefit could be obtained by the Somali fishing and seafood industries through improved value addition. Landing sites are not equipped with sufficient support services or infrastructure for off-loading, chilling, storing, and transporting fish. As a result, Somali fishers cannot leverage price premiums that accrue to processed fish. Developing small-scale processing facilities could enable fishers to add value to catches and provide a means to improve marketing opportunities.

Our conversations with Somali fishers reveal growing concern over the state of the resource, lost profits attributed to competition from foreign industrial vessels, and a lack of access to formal markets. If developed equitably, fisheries have the potential to be an important source of food and income security and, eventually, of stability.

Chapter 4: Sustainability of Fishing in Somali Waters

In Chapter 4, we assess the sustainability of fish stocks in Somali waters. We find almost half the groups of fishes we analyzed, including sharks and groupers, are currently fished at unsustainable levels. Other groups, including sardines and jacks, appear to be sustainable for the time being.

Additionally, we calculate the amount of fish that could be sustainably harvested from Somali waters, and we compare that to the amount of fish that is currently harvested from Somali waters. Our comparisons demonstrate marine top predators (e.g., tuna and sharks) are being harvested at maximum capacity and there is no room to sustainably increase catch of these fish. However, fishes such as sardines, anchovies, and some bottom fishes could sustain higher levels of catch in the future. For sustainable development to be successful, we recommend a more balanced approach to harvesting that decreases catch of top predators and increases catch of forage fishes and bottom fishes that are not currently harvested.

Ultimately, there are reasons to be optimistic about the sustainability of fisheries in Somalia. On average, Somali fisheries are more sustainable than in the rest of the world and immediate action to manage these fisheries could preserve that sustainability. However, caution is warranted. If Somali stocks continue on their current path, we estimate well over half of stocks will be fished at unsustainable levels in under a decade.

Chapter 5: Opportunities for Developing Somali Marine Fisheries

There is great potential in Somali fisheries, but there is also great risk. Run-away foreign fishing, much of it illegal, poses the greatest threat to the long-term health of the Somali fishery ecology and economy. In Chapter 5, we outline nineteen opportunities to support a sustainable foundation for Somali fisheries, for Somalis to reduce illegal fishing in their waters, and for international action to stop illegal and destructive fishing in Somali waters. Some of the most important opportunities include:

- Finalizing a mechanism for licensing foreign vessels and investing that revenue into the Somali fishery sector;
- Developing greater capacity for monitoring, control, and surveillance;
- Increasing data collection;
- Growing the domestic sector through investment in cold storage, freezers, and infrastructure;
- Developing fisheries management plans;

- Stopping foreign illegal fishing by enforcing sanctions against vessels;
- Improving data sharing by foreign navies and fishing vessels with Somali officials;
- Inspecting vessels suspected of fishing illegally in Somali waters that unload in foreign ports; and
- Supporting regional agreements to end IUU fishing.

Conclusions

Ultimately, Somali fisheries have the potential to bolster food and income security throughout the region. A more robust domestic fishery would increase jobs and wages in one of Somalia's most vulnerable employment sectors. Management of foreign fishing is important to ensure lasting benefits for Somalis. Given the decades of IUU fishing by foreign vessels within Somali waters, the international community bears a responsibility to help support sustainable fisheries through investment, regulation of its vessels, and respect for Somali law. Accordingly, investment in the Somali fisheries economy, especially infrastructure, would spill over and improve other domestic sectors, set the foundation for long-term prosperity, and improve national security.

ABBREVIATIONS

AIS	Automatic Identification System
ASCLME	Agulhas and Somali Current Large Marine Ecosystem Project
CMM	Conservation and Management Measures
CPI	Consumer Price Index (World Bank)
DG-Mare	Directorate-General for Maritime Affairs and Fisheries
DWF	Distant Water Fleets
DWFD	Distant Water Fisheries Development
EEZ	Exclusive Economic Zone
FAO	Food and Agriculture Organization of the United Nations
FGS	Federal Government of Somalia
FMC	Fisheries Monitoring Center
FPP	Fishery Production Potential
FSFA	Federal Somali Fisheries Authority
FV	Fishing Vessel
HMS	Highly Migratory Species
ICU	Islamic Courts Union
IDP	Internally Displaced Person
IMO	International Maritime Organization
IOTC	Indian Ocean Tuna Commission
IUCN	International Union for Conservation of Nature
IUU	Illegal, Unreported, and Unregulated fishing
LME	Large Marine Ecosystem
MCS	Monitoring, Control, and Surveillance
MMSI	Maritime Mobile Service Identity
MSY	Maximum Sustainable Yield
NECFISH	North-East Coast Fishing Enterprise
NGO	Non-Governmental Organization
OSY	Optimum Sustainable Yield
PSMA	Port State Measures Agreement
SHIFCO	Somali High Seas Fishing Company
SMRSS	Somali Maritime Resource and Security Strategy
TAC	Total Allowable Catch
TFG	Transitional Federal Government
TURF	Territorial Use Rights for Fisheries
UN	United Nations
UNCLOS	United Nations Convention on the Law of the Sea
VMS	Vessel Monitoring System
VSF-S	Vétérinaires Sans Frontières Suisse
WIO	Western Indian Ocean

CHAPTER 1. INTRODUCTION TO SOMALI MARINE FISHERIES

The Somali marine ecosystem is rich in a diversity of living resources. Dynamic oceanographic features attract migratory tuna, billfishes, and sharks. Warm tropical waters nurture coral reef systems that are home to hundreds of species of marine life, and highly productive open waters support schooling pelagic creatures such as sardines and squid. Yet Somali domestic fisheries are significantly under-capitalized when compared with those of neighboring countries in East Africa. Development of the fishery sector during the 1980s stalled after Somalia's civil war began in 1991, and the catch of marine life by domestic fleets has remained moderate ever since. Recently, interest in developing Somali fisheries has grown within multiple groups: fishers, entrepreneurs, and politicians within Somalia; expatriate communities outside Somalia and Somaliland; international non-governmental organizations (NGOs) and development agencies; the global fishing industry; and venture capital firms specializing in frontier and emerging markets.

For the past two-and-a-half decades, management of Somali fisheries has not been a top priority for government bodies faced with pressing security concerns, but welcome progress has been made in the past year. New fisheries laws were passed, the boundaries of an Exclusive Economic Zone (EEZ) were proclaimed, agreements between Somali regions and the Federal Government of Somalia (FGS) to manage and license fisheries were signed, and Somalia engaged with the international community in global fisheries management by joining the Indian Ocean Tuna Commission (IOTC).

Sardines, Tanaka Juuyoh, Flickr

However, caution is warranted. Despite a small domestic fishing sector, Somali waters are not pristine, nor have they escaped the detrimental effects of the overfishing that is all too common in today's oceans. Development organizations and investors may falsely assume Somali fisheries can support significantly higher levels of fishing pressure in the future. But the voices of Somali fishers tell a story of resources under pressure: declining catches and profits, polluted waters and damaged habitats, competition from foreign vessels, and the recognition that new and better fisheries regulations and management are needed.

Foreign fishing, much of it illegal, unreported, and unregulated (IUU), has generated public backlash around Somalia.[1,2] Foreign industrial vessels have been accused of attacking Somali fishing boats, destroying artisanal fishing gear, damaging habitat, and fishing without licenses (see Chapter 2). Unfortunately, there are no reliable estimates of the number of foreign fishing vessels operating in Somali waters, nor are there comprehensive records of what or how much they catch.

In the face of these challenges, Somali marine fisheries have the potential to improve income and food security in a region that could benefit greatly from higher levels of both. Somalia is home to approximately 10,000 part-time and full-time fishers,[3] and an additional 30,000–60,000 people are involved in different sectors of the domestic fishing economy (e.g., traders, processors, gear and vessel manufacturers).

Unfortunately, renewed interest in this sector could falter if additional steps are not taken to better manage Somali fisheries. Improved coordination between regional and federal authorities, greater data collection and analyses, and a comprehensive approach to fisheries regulation are critical. There has not been a systematic effort to collect scientifically rigorous data on Somali fisheries since the 1980s,[4] and updated information is sorely needed. Basic statistics—the amount and composition of catch, prices obtained for catch, biological information about target species—are not available. Consequently, the types of analysis needed to inform fisheries regulations are severely constrained.

The goal of this report is to help close the information gap about Somali fisheries by updating estimates of fishing in Somali waters, assessing the sustainability of important commercial fish stocks, measuring the economic potential of Somali fisheries, and identifying regulatory, political, and economic opportunities in both local and global fishing communities. Secure Fisheries aims to:

- *Promote sustainable harvests of Somali fisheries by identifying underutilized resources, highlighting challenges, and coordinating efforts.*
- *Provide a foundation for improved partnerships, data sharing, and transparency in Somali marine fisheries.*
- *Motivate the international community to prioritize the health of Somali fisheries and ensure that their vessels follow Somali law in order to promote jobs, growth, and stability.*

Ultimately, Somali engagement with the international community on issues of fisheries development has the potential to spill over and facilitate dialog and action in other areas of governance, planning, and society.

FIGURE 1.1 Map of Somalia and its regions (from UNEP).

1. POLITICAL AND ECONOMIC HISTORY OF SOMALIA

1.1 Early History

Somalia's equatorial location (Figure 1.1) on the Horn of Africa produces an arid landscape that historically supported a largely nomadic, pastoral society. The indigenous people of Somalia and the surrounding regions of northern Kenya, eastern Ethiopia, and Djibouti were self-organized as clans, and that structure formed the basis of the government.[5] These clan allegiances exist today, and the composition of the national parliament is based upon them. The southern reaches of Somalia, a fertile region between the two largest and most important waterways in the country, the Juba and Shebelle Rivers, were occupied by agricultural settlements. Across the rest of the country where arid climates persist, pastoral groups dominated.

Somalia's location at the crossroads of the African and Asian continents facilitated trade in commodities such as spices, gold, ebony, fiber products, and animal products like ivory, cattle, and some fish. During the sixth and seventh centuries, the

port cities of Mogadishu and Zeila became important hubs and stopovers for those traveling across the Indian Ocean to India and China.[6] Through this trade network, Islam expanded and became widely practiced, and it remains the dominant religion across Somalia today.[7] In more recent times, the history of Somalia has been marked by conflicts between sultanates and opposing world powers.

1.2 Colonial Rule

Beginning in the late 1800s and continuing through 1950, rival colonial powers occupied Somalia. Given its strategic position connecting Africa, the Middle East, and Asia, the ports of Somalia were highly desired and contested territory. The French were the first foreign power to gain a colonial foothold in Somalia in the 1860s, occupying what is now Djibouti. In 1887, Great Britain established a protectorate over Somaliland, and Britain and France reached an agreement defining their respective boundaries the following year. Italy colonized central Somalia in 1889, expanding their territory to include land ceded by the Sultan of Zanzibar in the late nineteenth century, territory east of the Juba River in 1925, and Somali-speaking parts of Ethiopia in 1936.[8]

The onset of World War II led to conflict in the Horn of Africa, with Italian and British forces occupying each other's territories in 1940 and 1941.[9] The Ogaden region was caught in this conflict. Held by the British on behalf of Somalia during World War II, it was ceded to Ethiopia in 1948, causing tension in the region during subsequent decades. In 1950, Italian Somaliland, at the time under British control, was declared a United Nations Trust and reverted to Italian control. Italian Somaliland was then granted internal autonomy and renamed Somalia in 1956.[10]

1.3 Independence

In July 1960, the British and Italian Somali territories merged to form the independent United Republic of Somalia, at which time their citizens elected Aden Abdullah Osman Daar as president.[11] Daar held the presidency for seven years before he was defeated by Abdirashid Ali Shermarke in the presidential elections of 1967. Two years later, Shermarke was assassinated and Mohammed Siad Barre assumed power in a coup. He declared Somalia a socialist state in 1970 and aligned Somalia with the Soviet Union.[12]

Under Siad Barre, cooperatives for fishing and agriculture were established throughout the country. With financial support from the Soviet Union, these cooperatives helped grow the domestic fishery sector. Though they did not always thrive, the infrastructure associated with cooperatives shaped the economic centers that exist in the country today.[13]

Relations with the Soviet Union soured in 1978 when Soviet forces helped expel Somali troops from the Ogaden region. Siad Barre responded by removing Somalia's Soviet advisors and realigning his government with the United States. This alignment held until 1990 when the United States pulled its financial and diplomatic support due to widespread reports of human rights violations and Barre's declining control of the country.[14] Siad Barre held power until January 1991 when growing opposition and civil war eventually toppled his government.[a] In May 1991, former British Somaliland declared independence as the Republic of Somaliland. In 1998, the Puntland region declared autonomy.[15]

The years following the overthrow of Siad Barre were marked by violence, political instability, and numerous attempts by the international community to establish a government. The lack of a recognized central government, coupled with intense civil fighting, destroyed Somali infrastructure and hobbled security forces, including those responsible for securing the maritime domain.[16]

1.4 Transitional Federal Government

In 2004, the fourteenth attempt to reestablish a central government commenced with the inauguration of a transitional parliament led by President Abdullahi Yusuf Ahmed. Due to security concerns, the Transitional Federal Government (TFG) was located in neighboring Kenya. In 2006, the transitional parliament convened in Somalia for the first time; however, several months later the Islamic Courts Union (ICU) took control of the capital, Mogadishu, and large swaths of the country.[17] The ICU was an Islamist group of Sharia courts that opposed the TFG. The international response was swift and the Ethiopian army removed the ICU from power in early 2007.[18] This conflict resulted in the heaviest violence seen in Somalia for fifteen years, causing the UN Security Council to authorize a six-month peacekeeping mission.[19] The defeated ICU splintered into many groups. Al-Shabaab, a jihadist extremist group that used terrorist

a Siad Barre died in exile in Lagos, Nigeria in 1995.

tactics and violence to gain control of south and central Somalia, rose to prominence.[20]

The TFG continued its attempt to exert influence over Somalia. In early 2009, a new parliament was sworn in, electing Sheikh Sharif Sheikh Ahmed president and extending parliamentary mandate for two more years. The final years of the TFG were characterized by internal power struggles and political positioning vis-a-vis Al-Shabaab, which formally aligned itself with al-Qaeda in 2010. Al-Shabaab pulled out of Mogadishu in 2011 and lost the towns of Baidoa and Afgoye to government-backed forces in 2012.[21]

1.5 Current Political Framework

After years of political turmoil, Somalia established a federal government upon the conclusion of the TFG's mandate in 2012. In August 2012, the parliament was sworn in, and the following month members of the parliament elected Hassan Sheikh Mohamud president.[22] After more than twenty years without a recognized central government, the establishment of the Federal Government of Somalia (FGS) provided Somalis with formal international representation.

However, the FGS is not the only authority in Somali territory. Somaliland has been a self-declared autonomous republic with an independent government since 1991, but it is recognized by the FGS and international bodies as an autonomous region that remains part of the Federal Republic of Somalia. Puntland, a semi-autonomous region, has its own administration, as does Galmudug, and both have their own presidents but coordinate with the FGS. Other regions have developed their own administrations as well. For instance, Jubaland declared itself to be a semi-independent state in 2013 but has been coordinating with the federal government. Somali state formation is an evolving process, and newly declared states are considered part of the Federal Republic of Somalia.[23, 24]

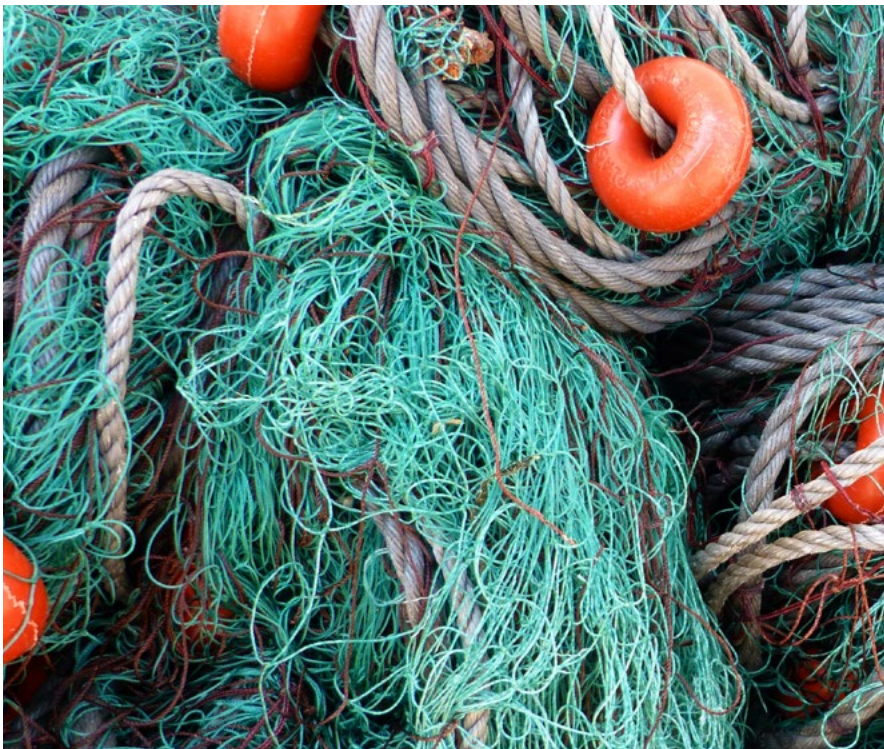
Although Somalia has a formally recognized central government and operational regional administrations, security remains a major concern. Al-Shabaab continues to pose a threat to stability and holds influence over large areas of Somali territory, serving as a major impediment to the Somali political process. Clan fighting and other security threats also hinder Somalia's ability to solidify a functioning government.

2. HISTORY OF FISHERIES LEGISLATION

2.1 National Fisheries Law

Somali fisheries have historically been characterized by low levels of governance. Fisheries legislation was first introduced with the 1959 Maritime Code.[25] The Maritime Code serves as the foundation for current Somali maritime regulation and provides an overview of fishing activities, prohibits certain fishing techniques (e.g., the use of dynamite), and establishes a vessel concession and licensing system. It empowers the Maritime Authority to conduct fisheries management and oversight. The Maritime Code was amended in 1966 and 1967; no copy exists of the 1966 amendment, and the application of the 1967 amendment has been unclear. The 1959 Maritime Code was updated again in 1988, but a copy of this legislation is not easily accessible.[26]

Fisheries Law No. 23 of 30 November 1985[27] expanded on the 1959 Maritime Code. It placed enforcement authority with the Somali Navy, updated the vessel licensing



framework to include an application process that increased accountability, and required fishery data collection. The Fisheries Joint Venture Guidelines[28] were also established in 1985 to govern fisheries cooperation between Somalis and foreign investors and to provide oversight of fisheries business development.

Due to civil war and the absence of a central government between 1991 and 2012, federal fisheries legislation was not updated again until November 2014 with the entering into force of the Somali Fisheries Law.[29] Regional fisheries legislation was passed in the interim by Somaliland, and Puntland established fisheries regulations based on the 1985 Fisheries Law. Notably, Puntland's Ministry of Fisheries and Marine Resources attempted to ban Somali lobster fishing in September 2014 due to conservation concerns.[30] This measure was reportedly overturned quickly due to pushback from communities that rely on the lobster trade.[31]

2.2 Somali Maritime Resource and Security Strategy (SMRSS)

In 2013, the FGS, Somaliland, and the Somali regions, supported by members of the international community, developed the Somali Maritime Resource and Security Strategy (SMRSS). The SMRSS directs future secure and sustainable development of the Somali maritime sector, including marine resource management. The SMRSS also has six corresponding thematic annexes that act as a roadmap for its implementation. These include steps to combat IUU fishing in Somali waters and properly manage fisheries by enacting legislation, creating monitoring and control systems, and joining regional fisheries management organizations. Additionally, the SMRSS outlines a path for sustainable economic development of Somali marine resources.[32] While efforts are underway to develop the Somali maritime sector, a consensus among the FGS, Somaliland, and the regions about adoption and implementation of the SMRSS is still lacking. A review of the strategy is underway to refine its usefulness and develop ways forward.

2.3 Somaliland Fisheries Law

Somaliland fisheries are governed by the Somaliland Fisheries Law.[33] This law is based primarily on the aforementioned Fisheries Law No. 23 of 30 November 1985. The law places management authority with the Ministry of Fisheries and addresses the Somaliland maritime zone, resource management, and licensing. Additionally, Somaliland passed the Somaliland Fisheries Regulations, expanding on the law. The regulations seek to align exploitation levels with resource management principles. Consistent enforcement remains a challenge.

2.4 Current National Law

Today, authorities in Somalia and Somaliland are working to increase governance of fisheries resources. The Somali Fisheries Law,[34] signed into force in November 2014, provides a comprehensive overview of the goals, management concerns, and prohibitions around Somali fisheries. The new law mandates utilizing optimum sustainable yield, bans bottom trawling, increases requirements for reporting, and focuses on conservation concerns for endangered species. Additionally, the law invalidates all fishing licenses issued between January 1991 and the ratification of the Somali Fisheries Law, regardless of who issued them.[b] The passage of the updated Somali Fisheries Law also repeals any law that contravenes the act.[c]

While this legislation is a positive development in terms of fisheries governance, acceptance by the regions, and implementation and enforcement, need to be addressed.[35] Somalia's low capacity for law enforcement

b Article 16: Issuing of Foreign Fishing License, Somali Fisheries Law.
c Article 43: Repeal, Somali Fisheries Law.

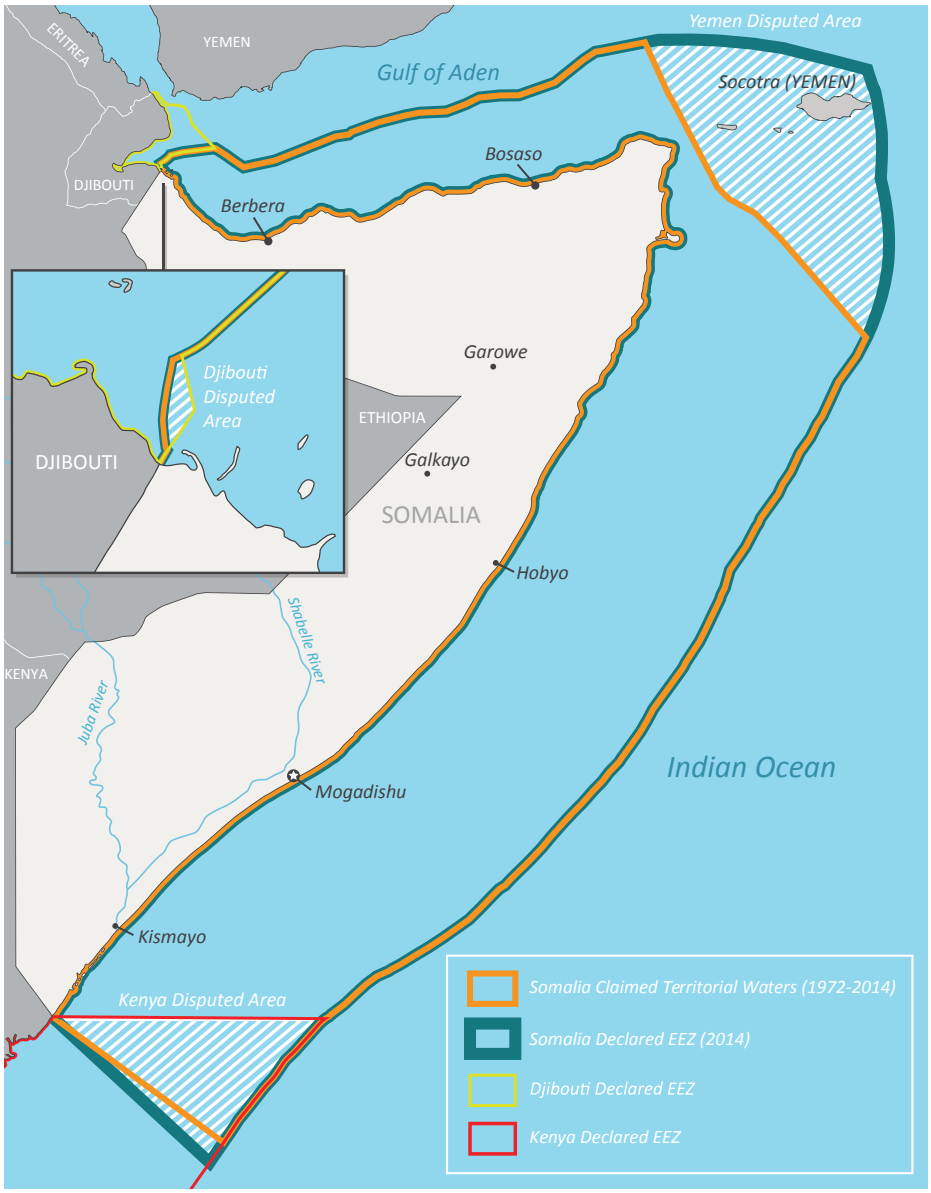
poses challenges to the efficacy of the law. Finally, significant steps in data collection and analysis are needed before estimates of the status of fish stocks and benchmarks for optimum sustainable yield can be generated.

2.5 The Exclusive Economic Zone

As defined by the United Nations Convention on the Law of the Sea (UNCLOS), an Exclusive Economic Zone (EEZ) is the area beyond the territorial sea (out to 12 nautical miles or 22 km from shore) up to 200 nautical miles (370 km) out to sea from the coast. Within the EEZ, the coastal state has sovereign rights for the exploitation, conservation, and management of natural resources, both living and non-living; this includes the management of fisheries resources.[36]

In June 2014, the FGS declared its EEZ (Figure 1.2) in line with UNCLOS.[37] Prior to this proclamation, Somalia claimed territorial waters out to 200 nautical miles (310 km) from shore. The territorial waters were declared in 1972, prior to the ratification of UNCLOS, and Somali fisheries law applied to this declaration. There are disputes over EEZ authority and boundaries among the FGS, regions, and neighboring countries. Yemen, Kenya, and Djibouti dispute the boundary designations,[38] and Somaliland disputes the authority of the FGS over its waters.[39]

FIGURE 1.2 Map of Somali territorial waters (1972-2014), current proclaimed Somali EEZ (2014-present), and EEZ boundaries disputed by Yemen, Kenya, and Djibouti.



3. THE MARINE ENVIRONMENT AND ECOLOGY OF SOMALI WATERS

3.1 Oceanography

Somalia dominates the Horn of Africa coastline. At 3,300 km in length, it is the longest coastline in continental Africa. Somalia is bordered by the Gulf of Aden to the

north and the Indian Ocean to the east. The continental shelf, where most marine resources are concentrated, is relatively narrow (approximately 15 km wide) except near Ras Asir and Ras Hafun in the northeast, where it reaches up to 100 km wide (see Figure 1.1).

Local currents are driven by the main current system of the Indian Ocean and the Intertropical Convergence Zone, which creates the Southwest and Northeast Monsoons.[40] The monsoons create two distinct seasons. In March through October, the Southwest Monsoon reinforces the East African Coastal Current and forms the fastest open-ocean current in the world, the Somali Current, driving easterly flow out of the Gulf of Aden. This high flow produces intense upwelling, called the Great Whirl, which generates an influx of cold, nutrient-rich water along the coast.[41] During October through March, the Northeast Monsoon causes the coastal current to reverse flow and drives the southwesterly flowing Equatorial Countercurrent. This flow suppresses upwelling and drives water westward from the Arabian Sea into the Gulf of Aden.[42] Such seasonal oceanographic variability supports a wide variety of marine ecosystems in Somali waters.

In the Gulf of Aden, the 1,300 km shoreline is characterized by high-energy, sandy beaches with intermittent rocky outcrops and cliffs. The cool, nutrient-rich summer upwelling promotes the growth of macroalgae on hard substrates and limits coral growth, though some seagrass beds and coral communities do exist.[43]

Coral reefs are present around the Sa'ad ad-Din Islands, Habo, and between Buruc and Bosaso. From Bosaso to the tip of the Horn at Ras Asir, mountains reach the sea and there are few sandy beaches.[44] The northern east coast between Ras Asir and Eyl is similar, consisting largely of rocky outcrops and few beaches. A transition to sandy beaches and patch coral begins in Eyl and continues south to Mogadishu where the barrier islands and reef systems create shelter.[45] The reefs are influenced by the tropical waters flowing north from the coasts of Kenya and Tanzania.[46] The largest reefs in this part of the country are barrier reefs that begin near Mogadishu and extend past the southern border with Kenya and into Kenyan waters, including the barrier Bajuni Islands.[47]

3.2 Economically Important Fishes and Invertebrates

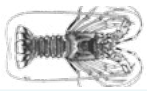
Variable ocean conditions create ecosystems in Somali waters that support a high level of diversity of fishes, from demersal fishes associated with reefs and the seafloor to pelagic species that feed on prey supported by nutrient-rich upwelled waters. We chose a subset of Somali fishes and invertebrates to include in our analyses based on work by the Sea Around Us,[48] a review of literature,[49] and consultation with experts (Table 1.1). The information in this section is derived from Bakun et al.,[50] Sommer et al.,[51] and FishBase.[52]

Many reef-associated, demersal species of the grunt, emperor, grouper, goatfish, snapper, jack, seabream, and lizardfish families are important fisheries in Somalia, especially for artisanal fishers. These fish are generally found close to shore, making them easier to catch from small boats with artisanal gear like handlines and nets, or without a boat at all, using beach seines. Grunts, emperors, goatfishes, and seabream feed on benthic invertebrates and can grow quite large (Table 1.1). Jacks and lizardfish are more predatory, consuming other fishes and invertebrates. Jacks are often found in schools, making them susceptible to high exploitation by purse seine gear.

Sharks are ecologically important as top predators in both reef ecosystems and the pelagic environment (see Box 3.2). Additionally, they are a key component of coastal fisheries in Somalia as liver oil, dried shark fins, and meat are important local and export products. Shark fins fetch a high price compared to shark meat and other fish products (see Chapter 3), making sharks targeted over other fishes. Species that frequent reefs and inshore habitats, such as blacktip reef shark (*Carcharhinus melanopterus*), thintail thresher shark (*Alopias vulpinus*), and hammerhead sharks (genus *Sphyrna*), are likely to be captured by the Somali fleets and are therefore most heavily exploited.

The pelagic fishes that inhabit Somali waters can be divided into two groups: small pelagics including sardines, herring, and anchovies, and large pelagics including tuna, billfishes, mackerel, and dolphinfish (Table 1.1). Small pelagics are silvery, cylindrically-shaped schooling fish that comprise the largest fishery in the Indian Ocean, especially the Indian oil sardine (*Sardinella longiceps*), though they are not a large component of the Somali domestic catch. As a schooling fish, they are easily

Table 1.1 Summary of economically important fishes and invertebrates found in Somali waters.

		Category *(in Somali)*	Family	Common Size Range (cm)	Common Habitat	Catch Methods in Somali Waters
Coastal and Demersal Fishes		Emperors *(gaxash, dhuuwane, miraamir, afdheere)*	Lethrinidae	20-100	shallow to mid-depth, benthic, coastal, reefs, lagoons, seagrass	handline, trap, seine, gillnet, bottom trawl
		Goatfishes *(gocoore, fangalaato, labogarile)*	Mullidae	20-50	shallow to mid-depth, coastal, reefs, lagoons, sandy bottoms, muddy bottoms	pole and line, trap, beach seine, gillnet, bottom trawl
		Groupers *(summaan, caalo, gadiir, yaagur)*	Serranidae	14-270	shallow to mid-depth, demersal, reefs	pole and line, trap, bottom trawl
		Grunts *(shoox, cadaasho)*	Haemulidae	16-100	shallow, coastal, reefs	handline, trap, longline, bottom trawl
		Jacks, Scads, Trevallies *(bayaad, caari-joog, doorab, baroole, jabto)*	Carangidae	18-170	shallow to mid-depth, coastal or pelagic, reefs	pole and line, handline, gillnet, trawl, purse seine, beach seine
		Snappers *(booraad, qardabo, tartabo, cayje)*	Lutjanidae	30-150	shallow to mid-depth, rocky bottoms, reefs	handline, longline, bottom trawl, gillnet
		Lizardfishes	Synodontidae	16-50	estuarine and marine, inshore	bottom trawl
		Seabream/ Porgies	Sparidae	30-90	shallow to mid-depth, benthic, coastal, reefs, muddy bottoms	bottom trawl, longline, handline, trap
Sharks and Rays		Sharks *(geesoole, libaax, miishaar, seefle, saraciimo, nedaraan, baalcadde)*	Sphyrnidae, Lamnidae, Alopiidae, Carcharhinidae	400-760	shallow and epipelagic, reefs and oceanic	longline, gillnet, handline
		Rays *(safan, baalalay)*	Dasyatidae, Myliobatidae	147-330	shallow, coastal, pelagic or benthic	longline, pole and line, handline, bottom trawl
Small Pelagic Fishes		Sardines, Herrings *(carabi, buraasow, simbilling, caydi)*	Clupeidae	7-24	pelagic, coastal, schooling	seine, gillnet, trawl, castnets
		Anchovies	Engraulidae	8-18	pelagic, coastal, schooling	seine, trawl, stakenet, castnets
Large Pelagic Fishes		Billfishes *(daabbiri, faras)*	Istiophoridae	230-500	epipelagic, oceanic	longline, gillnet, troll
		Tuna *(tabadin, yajdar-baal-cagaar, dhiglow ama shirwo, tabad, jeedar, sannuuro)*	Scombridae	50-250	epipelagic, oceanic, some schooling	longline, gillnet, troll, handline, purse seine, pole and line
		Mackerel *(derik, tabadin, jeedar)*	Scombridae	38-240	epipelagic, coastal and oceanic, schooling	gillnet, trawl, purse seine, pole and line
		Dolphinfish	Coryphaenidae	75-210	pelagic, inshore and offshore	longline, purse seine, gillnet, pole and line
Invertebrates		Cuttlefish *(sunaani, tootane)*	Sepiidae	5-50	shallow to mid-depth, demersal	trawl, jig, trap
		Squid *(duusho)*	Loliginidae, Onychoteuthidae	30-100	shallow to deep, neritic	trawl, seine, jig
		Lobsters *(arigoosto)*	Palinuridae	9.5-50	shallow to deep, reefs, rocky, muddy, and sandy bottoms	trap, diving, trawl, spear, nets
		Shrimp and Prawns *(ayax badeed, gaambiri, shiribis)*	Penaeidae	7-34	shallow to mid-depth, benthic	trawl, seine, gillnet

Illustrations from fao.org

captured in large quantities with seines and castnets. These fish are important food fish for the large pelagic fishes and are therefore crucial to the pelagic ecosystem.[53] Tropical tuna, mackerels, and billfishes are fast-swimming, oceanic top predators of other fish, crustaceans, and cephalopods. These highly migratory species (HMS) migrate long distances, making them especially challenging to manage because their ranges cross many countries' EEZs and international cooperation between coastal countries and distant-water fishing nations is vital. Tuna meat is very high quality and is popular worldwide as fresh, frozen, canned, and salted products. This desirability means they are intensely targeted in the Western Indian Ocean by longline and purse seine vessels from Taiwan (Province of China), Japan, Spain, India, the Maldives, Iran, Oman, Pakistan, Yemen, the Seychelles, and France (among others). Globally, some species are listed as Vulnerable (bigeye tuna, *Thunnus obesus*) or Near Threatened (yellowfin tuna, *Thunnus albacares;* and albacore tuna, *Thunnus alalunga*) by the International Union for Conservation of Nature (IUCN). Mackerel are important components of both Somali and foreign catches. The most commonly caught species is the narrow-barred Spanish mackerel (*Scomberomorus commerson*), often called kingfish. These fish exist in the coastal Indo-West Pacific where they undergo lengthy migrations and are targeted by local fishers.

Spiny lobsters are the most commercially important invertebrates caught in Somali waters. The majority of the catch consists of five shallow, reef-dwelling species. In the Gulf of Aden, the main species are the painted spiny lobster (*Panulirus versicolor*) and the pronghorn spiny lobster (*Panulirus penicillatus*). On the east coast, the main species are the longlegged spiny lobster (*Panulirus longipes*), the ornate spiny lobster (*Panulirus ornatus*), and the scalloped spiny lobster (*Panulirus homarus*). Spiny lobsters are nocturnal, hiding in hollows and caves during the day. They are easily captured by hand or spear by divers, as well as by traps and nets laid over the reef.[54] There are also deep-water species of lobsters (*Puerulus* sp.), but little catch data exists. The lobster sector is one of Somalia's oldest fisheries and was one of the first marine exports out of Somalia to the Middle East. Shrimp and prawns also are subject to high exploitation in Somali waters. There is a year-round fishery targeting prawns at the mouth of the Juba River in southern Somalia near Kismayo.[55] Cephalopods (squid and cuttlefish) are also caught in significant numbers. These soft-bodied animals are important prey items for many fish species and attract international trawl vessels.

4. HISTORY OF FISHING IN SOMALI WATERS

4.1 Artisanal Fishing

The history of artisanal fishing in Somalia is a short one for a country with such a long coastline and abundant marine resources. The Somali people have traditionally been a pastoral nomadic society that depended on herding animals and seasonal agriculture for subsistence and as the basis of their economy.[56] Nationally, fish has not been a significant portion of the Somali diet and fishing was not a robust means of livelihood outside of the handful of coastal communities participating in the dhow trade with the Middle and Far East. Rough seas combined with the lack of natural harbors and accommodating boat landing sites along the rocky, cliff-lined coast meant few fishing villages existed in Somalia prior to the unification of the country in 1960.[57, 58]

Somali Surgeon fish, Jean-Pierre Larroque

Though small in population, two traditional fishing societies exist: the Amarani and Bajuni. These groups trace their ancestry to Arab and Persian settlers and Indian and East Indian seafaring people who landed in Somalia over 1,000 years ago. The Amarani, who numbered fewer than 1,000 people in 1990, are spread throughout fishing communities in and near Brava, Mogadishu, Merca, and inland Afgoye. The Bajuni are found throughout the east African coast from Kismayo to as far south as Lamu, Kenya. Both groups are culturally distinct from ethnic Somalis as a result of their geographic isolation and traditional language of Swahili.[59]

These communities practiced subsistence fishing using traditional crafts that are still in use throughout the country. The *houri* is a canoe-style boat 2–3 m long, traditionally made of dug-out logs brought from India, or more recently made out of planks, and powered by paddles or a small triangular sail. *Mashuas* are sailboats about 12 m long and are used in the far south. In the northeast, *bedens* have been used. These are 6- to 10-m sawn plank boats with oars and a sail. Methods of fishing from these traditional boats include trolling and handlining for tuna, kingfish, and sharks, as well as gillnetting for sharks and castnetting for sardines to use as bait.

Due to the lack of cold storage and ice in the country, a problem that persists in modern-day Somalia, artisanal catch was primarily eaten fresh, salted and dried, or smoked and sun-dried as a product called *haniid*. These dried products were sometimes traded to Middle Eastern *dhows*, traditional wooden or fiberglass boats that vary considerably in size and form.[60]

During the early 1970s, after Siad Barre's regime took power, local authorities began to appreciate the potential of the underutilized fishing sector for food and export products. After a series of droughts ravaged the country's grazing lands, the government actively promoted the fishing sector. The Ministry of Fisheries and Marine Transport organized fishing villages into approximately 21 cooperatives.[61] The cooperative structure provided fishing gear and set prices for fish, giving fishers a more stable and viable financial stake. In 1973–1975, a major drought caused widespread starvation and displacement. In response, the government resettled 15,000 nomads into four fishing cooperatives. Because the resettled peoples lacked fishing skills and associated knowledge, the four resettlements failed within five years.[62]

As a whole, however, the fisheries sector did relatively well over the next decade and a half. Countries with commercial interest in developing Somali fisheries and with political interest in the region, notably the USSR, Sweden, Kenya, Greece, Italy, and Sri Lanka, aided the central Somali government in distributing motorized boats to the cooperatives. These boats initially increased efficiency in the artisanal sector, but cooperatives were not equipped with sufficient spare parts or maintenance capacity, so many boats quickly fell into disrepair.

Somali Fair Fishing, Jean-Pierre Larroque

International interest in Somali fisheries also opened trade channels to Europe through the Middle East and to other African countries.[63] By the late 1980s the fisheries sector began to thrive, but progress was quickly halted by the outbreak of the civil war, the ouster of Siad Barre, and the resulting three decades of violent fighting. During this period of civil conflict, what little support the artisanal fishing sector was getting from the central government vanished and only a modest effort continued in fishing communities. In the mid-1990s, export markets remained for lobster to the Middle East and shark to Asia, and private companies began filling the vacuum left by the collapsed government.

Nevertheless, infrastructure was crumbling or destroyed from the war and there was little cold storage for fish, so Somali seafood products lacked the quality needed to compete on the world market. A battle to create profitability from the small-scale sector continues to this day, and progress was hampered further by the tsunami that devastated many fishing villages on the east coast in December 2004.[64] The massive wave damaged buildings, boats, and fishing gear. It forced some fishers to evacuate, and many never returned to the coast. Those who stayed received some financial and material aid from international agencies to replace fishing gear.[65]

Over the past few years, the political situation has become less volatile but remains unstable. This has created room for some expansion of the fishing industry by private, Somali-owned companies. There are companies with processing facilities operating out of the larger coastal cities such as Berbera, Bosaso, Kismayo, and Mogadishu. These companies either maintain their own small fishing fleets or purchase fish from local fishers for the Somali or international markets.

The cultural attitude towards eating fish is changing[66] and consumption in Mogadishu, for instance, has increased, though it is still low compared to global levels of consumption.[67] From an economic and business perspective, Somalis see a great future for growth in the fishing industry, though the continued lack of infrastructure and support may hamper that potential.

4.2 Fishery Infrastructure

The lack of infrastructure for hygienically storing, processing, and transporting fish products is one of the major impediments to the development of the Somali domestic fishing industry. Though there was early investment in canning factories, processing facilities, and cold storage during the colonial era and the Siad Barre regime, instability in the country since then has inhibited progress.

In the early twentieth century, after industrialization, and when the potential of Somali fisheries began to be realized by the occupying Italians, private Italian investors built tuna canneries in Alula, Candala, and Habo. While the Alula factory closed after a short time, the Candala factory has operated nearly continuously since its construction.[68, 69] The Habo cannery operated through 1995. A new facility is now in use there.[70] Additional canneries were built in the 1950s in Bosaso and Las Koreh, though these have operated intermittently. A large cold-storage facility was built in Bolimog during the same time period, but it never operated at commercial capacity due to a lack of market access. Development in Kismayo also began in the late 1960s with the construction of the port and a fish processing facility complete with cold storage. The cold storage and processing facilities operated intermittently until the civil war, when they were destroyed. Today, Kismayo is one of the largest ports and landing sites in Somalia.[71,72,73]

The Siad Barre government oversaw the expansion of existing facilities and construction of additional ones in support of the fishing cooperatives, especially during the 1980s. Cooperative buildings for the processing and storage of fish were built in Bander Beyla, Eyl, Zeila, Heis, Mait, Bargal, Hobyo, Adale, Merca, Brava, Kamboni, Mareeg, Habai, and Ras Hafun. These had varying capacities and abilities. Some were simple structures, without refrigeration, in which filleting, salting, drying, and smoking of fish, primarily for export,[74] took place. Some facilities were more advanced and included cooling or freezing capacity, especially those built with outside support by the Food and Agriculture Organization of the United Nations (FAO), Vétérinaires Sans Frontières Suisse (VSF-S),[75] or NECFISH.[d, 76, 77]

Large facilities including cold storage and processing areas were also constructed in Berbera and Mogadishu,[78] cities that continue to be epicenters of fishing and port activity for Somaliland and southern Somalia, respectively. During Siad Barre's time as ruler, boat-building operations were located in Kulmis, Kudhaa, Bander Beyla, and Bosaso for sailboats, and in Merca and Mogadishu for canoes. The Somali Glass Fibre Reinforced Plastics Products Company also opened in 1983 in Mogadishu, providing fiberglass boats to main fishing areas. Unfortunately, many of these facilities were damaged, looted, or destroyed during the civil war.

After 1991 and during the subsequent two decades of civil war, fisheries infrastructure development was slow. Resources to rebuild many damaged buildings did not exist. Progress was further impeded by the tsunami of 2004 that impacted the north east coast of Somalia, especially Puntland, and destroyed boats, gear, and facilities along the coast.[79] While there has recently

d North-East Coast Fishing Enterprise, a government-run fisheries development program based in Bosaso that received funding from The World Bank

been investment in fishing companies made by local and international businesses, the methods of fish processing have gone largely unchanged since the early twentieth century.

The lack of civil infrastructure also presents a challenge to fisheries development. Many of Somalia's ports are run-down. The largest and most advanced ports are in Mogadishu, Berbera, Bosaso, and Kismayo. Berbera, for example, can accommodate six large ships at a time and has modern facilities for loading and unloading. Its capacity has been vastly improved over the last decade.[80] Though large for Somalia, these ports have relatively small capacities compared to other countries' ports and have not kept pace with the growing size of boats in the international fleet. They also have limited access to processing facilities and local and international markets. Consequently, it is significantly easier and safer for large fishing vessels to land their catch in larger neighboring ports such as Mombasa (Kenya), Salalah (Oman), or Djibouti City (Djibouti).

Air transport is a more reliable means of exporting fish from Somalia. There are many airports in Somalia and flying seafood out of Somalia is common and relatively convenient because most of the main export destinations are in the Middle East (Yemen, Oman, and the United Arab Emirates). Transporting fish by land is difficult. Refrigerated trucks preserve fish during transport, and some are in use in Somalia. However, their use is limited because the roads are mostly unpaved and travel is arduous and slow. In fact, there are no paved roads along the coast of Somaliland at all, making transport by truck especially difficult.[81]

4.3 Joint Ventures

Fishery joint ventures were created by the Siad Barre government. These endeavors were loosely defined as "a cooperation exercise between Somali and Foreign investors set up for a specific fisheries business [*for*] a limited time, temporarily pooling resources and skills, with risk bearing and risks[sic] taking by both parties."[82] These operations were issued licenses, opening the door to authorized foreign fishing. Though many of the partnerships dissolved during the civil war, vessels from some joint ventures continued to operate for years (or even decades) after 1991 when the licenses should have expired and the government that had made the guidelines no longer existed. Many of these joint ventures provided fish directly to importers in the countries involved. The fisheries infrastructure needed to support these operations was of benefit to the local fishing communities, but most of the profit was not realized by Somalis. Table 1.2 summarizes the documented joint fishing ventures developed in Somalia.

4.4 Foreign Fishing in Somali Waters

In addition to joint ventures, unilateral fishing by foreign vessels has played a large role in Somali waters. Chapter 2 presents a comprehensive analysis of foreign fishing in Somali waters; here, we summarize the presence of foreign fleets (see Figure 1.3). Foreign fishing in Somali waters can be broadly divided into two categories: vessels fishing for tuna and tuna-like species (highly migratory species - HMS), and vessels fishing for coastal pelagic or bottom-dwelling species, including lobsters and squid. Foreign vessels targeting HMS are primarily large, industrial longline or purse seine vessels from

> ***If something is not done about this [foreign fishing], they will overfish to the point where there will be no fish left.***
>
> **Fisher, Somaliland**

Asian and European distant water fleets or smaller gillnet vessels from neighboring countries such as Yemen and Iran.[109] These vessels are managed under the regional management framework of the IOTC. Foreign vessels pursuing coastal and bottom-dwelling species are a mix of industrial trawlers and coastal dhows that may target shrimp, squid, emperors, or snappers, and they represent a diverse geographic range from Kenya to South Korea.

Fishing for HMS by foreign parties in Somali waters has occurred since the early twentieth century, beginning with Italian investment in tuna canneries to support an export market.[110] Publicly available catch data[e] from the IOTC shows longlining by Japanese vessels in the 1950s and by Taiwanese vessels (Province of China) in the late 1960s in what are now Somali waters.

The purse seine fleet is composed primarily of EU-flagged vessels and EU-owned vessels flagged to other nations.

e See http://securefisheries.org/report/securing-somali-fisheries for animations depicting the locations of catch reported by IOTC nations throughout the Indian Ocean.

TABLE 1.2 Summary of joint fishing ventures operating in Somali waters.

Joint Venture Name	Country Involved	Years of Operation	No. of Boats	Type of Boat
SOMALFISH[83,84,85]	USSR	1974–1977	10	Trawler
			1	Fishmeal factory ship
		1979–1984	2	Prawn trawler
Delta Co.[86,87]	Italy	1976–1985	1	Trawler
SIADCO[88,89]	Iraq	1977–1982	4	Trawler
Amoroso e Figili[90]	Italy	1978–1979	3	Trawler
SOMITFISH[91,92,93]	Italy	1979	11	Trawler
		1980–1983	3	Trawler
		Late 1980s	1?	Trawler
SHIFCO[94,95,96,97]	Italy	1981–1982	1–7	Trawler
			1	Freezer storage vessel
		1983–2006	2–5	Trawler
Seafish[98]	Italy	1983	2	License
NECFISH[99,100]		1984–1985	2	Experimental trawler
Afro Fishing Company[101]		1985	2	Trawler
Somali Marine Products[102,103,104]	Germany	1988–1991	12	Fishing vessels
			1	Trawler
			1	Collection boat
SomAust[105]	Australia	1994–1995	1	Prawn trawler
Basta and Sons[106]	Italy	2005–2008		Prawn trawler
ITTICA S.P.A.[107]	Italy	2008	1	Trawler
Ras Asayr Fishing General Trade Co.[108]		2011–present	40	Fishing vessels

Fishing by French vessels started in the mid-1980s, and significant purse seining by Spanish vessels began in 1985. The Seychellois purse seine fleet, primarily owned by Spain, expanded beyond its EEZ in the early 2000s, but current levels of effort in Somali waters are fairly low. There has also been recent development of a Mauritian fleet of French-owned purse seiners. Finally, Yemen and Iran target HMS, primarily tuna, using gillnets.

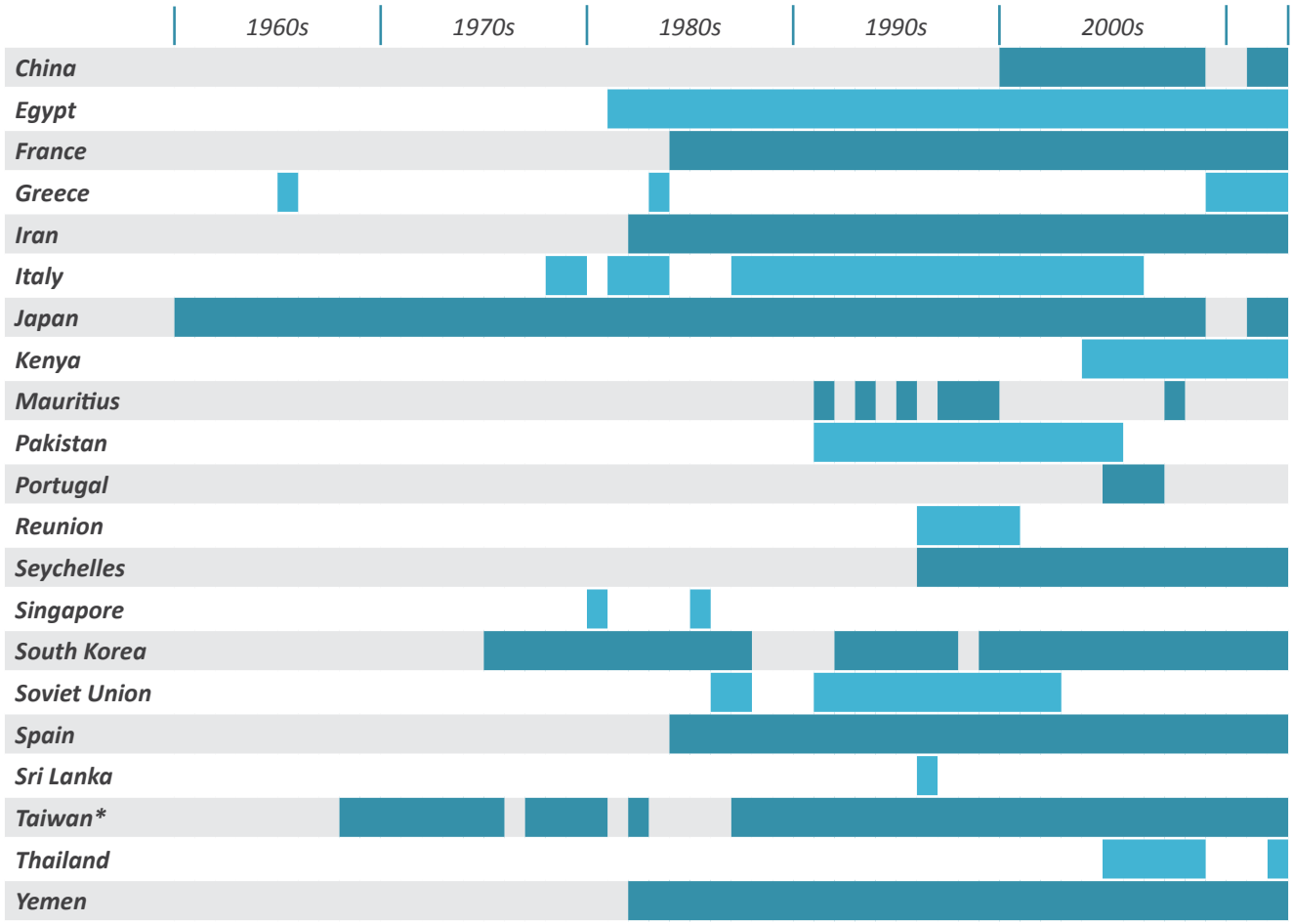
The foreign HMS fleet has dramatically reduced its reported presence in Somali waters since 2006 for various reasons. First, private agreements between the EU purse seiners and Somali authorities expired in 2006 and have not been renewed. Second, the risk of piracy grew significantly during the mid-2000s,[111] and many foreign vessels chose to avoid Somali waters as a consequence.[112] Today, with a decline in pirate activity in the region, foreign fishing for HMS has rebounded for some fleets.

Capture of coastal and demersal fishes by foreign vessels tends to be carried out by demersal and midwater trawlers. Foreign commercial trawling not associated with any joint venture began in the 1980s. Singapore, Greece, and France operated trawlers during the 1980s, but records of their catch are not available. After the dissolution of SHIFCO (a joint venture with Italy) in 1998, Italian trawlers remained in Somali waters and supplied the Italian market with squid and demersal fishes. South Korean trawlers took over the Italian market in 2006; in early 2015, four of them re-flagged to Somalia and operate to this day. Finally, three dozen Egyptian trawlers have operated in the Gulf of Aden under license from Somaliland since at least 2003.

If properly licensed and sustainably managed, foreign fishing could provide an important source of revenue that could be reinvested in domestic fishery development. In its current form, however, foreign fishing is not generating much income through licensing, catch is not reported to Somali officials, and Somali fishers blame their declining catches on unregulated and rampant fishing by foreign fleets (Box 2.1). There exists today an opportunity to regulate and license foreign vessels in a profitable and beneficial manner that does not sacrifice the livelihoods of Somali fishers.

> ***[Foreign fishers] are pirates. They are the ones who are destroying the fish habitat. They catch all kinds of fish and keep only the valuable ones. They dump the unwanted fish in the ocean and that is a national tragedy.***
>
> Exporter, South Central region

FIGURE 1.3 Presence of foreign fishing vessels in Somali waters (1960-2013).



This chart represents all foreign vessel types including industrial longliners, purse seiners, gillnetters, trawlers, and coastal dhows
**Province of China*

4.5 The Piracy Connection

In Somalia, it is difficult to separate the discussion of fisheries resources from the issue of maritime piracy. Piracy captured the world's attention in the early twenty-first century, and off the coast of Somalia it is often linked to the illegal exploitation of Somali fisheries resources.[113] Somali fishers began to express their frustration with foreign fishers in the early 1990s. Their complaints coincided with the fall of Siad Barre's government in 1991, which left Somali waters without a legitimate authority to enforce the law and without a coast guard or naval capabilities. These conditions, within the broader context of growing distant water fishing fleets (DWF), gave way to an influx of foreign fishing boats.

The movement of foreign vessels into waters utilized by Somali artisanal fishers led to increasing conflict between Somali fishers and foreign fishers in the early and mid-1990s.[114] Deliberate destruction of locals' fishing gear, use of violence by foreign vessels, concern over lost livelihoods, and the perception that the international community was acquiescent to illegal fishing led to the formation of groups of fishers who targeted foreign fishing vessels and commercial traffic.[115] These attacks were mostly opportunistic, focused on stealing equipment or other items. However, they soon escalated, with the first reported hijacking for ransom occurring in late 1994 when two SHIFCO fishing vessels were hijacked and released for a large ransom.[116]

Recognizing the increasing conflict between Somali and foreign fishers in the early to mid-1990s, and emboldened

by the lack of government authority, warlords began to sell fishing access rights to foreign vessels in the form of illegitimate licenses. In return, they provided protection against attacks.[117] Around 1998, these agreements fell apart because warlords did not follow through on the protection they had promised. These illegitimate access agreements were not the only attempt to fill the vacuum created by the fall of Siad Barre's government. The autonomous Puntland government developed its own licensing scheme for foreign boats in 1999; however, this arrangement was short-lived as turmoil within Puntland in 2001–2002 dissolved this process.[118]

The movement towards hijack for ransom evolved piracy from loosely organized groups of fishers to the highly organized business model employed since the early-2000s.[119] While piracy did find its origins in conflicts between artisanal Somali fishers and foreign fleets, these small-scale attacks were quickly appropriated by warlords with criminal networks and international financing. These criminals sought to maximize profit above all else by attacking any vessels passing in and beyond Somali waters.[120] Although warlords claim to protect Somali fishers and resources through piracy, they had actually enabled IUU fishing through their earlier access agreements and by providing onboard armed security to foreign fishing vessels since 2012.[121]

The 2004 tsunami added to the Somali maritime challenge. The tsunami destroyed fishing villages, infrastructure, and equipment along Somalia's coastline. This left thousands of fishers without a livelihood, and there was no state response to provide support, creating yet another source of frustration. The combination of a failed state and the inaction of international actors in deterring IUU fishing fed discontent within coastal and fishing communities. From the fall of Siad Barre's regime and through the period of escalating piracy, Somalis were left without a viable way to manage their sense of disenfranchisement at the hands of outsiders. Instead, their frustrations produced a narrative of self-defense that has been used to justify violence against foreign fishers and seafarers.[122]

The international response to piracy effectively curtailed the hijackings of commercial vessels.[123] However, it did not address the role that illegal fishing has played in promoting piracy. Foreign fishing vessels are still seen as a threat to the livelihoods of Somali fishers.[124] Somalis feel they cannot defend themselves against this threat (Box 2.1). While the international community has taken major steps to protect commercial vessels from piracy, they have done little to curb foreign fishing; some Somalis see this as enabling illegal fishing.[125] Foreign fishing is still rampant and these sentiments still exist, raising the risk that piracy could reemerge now or in the future.[126]

A number of factors have changed since the 1990s. For example, Somalia proclaimed its EEZ in 2014, which makes it more difficult for distant water fleets to justify an unlicensed presence in Somali waters. Somalia also now has an internationally recognized government with a mandate to promote development of the maritime economy. Though a true fisheries authority is not yet fully functional, the FGS is currently working to create a national maritime administration to regulate fishing and issue licenses. During a meeting of the SMRSS Fisheries Working Group in April 2014, the Somali regional representatives, Somaliland, and the federal fisheries minister agreed that a fishing authority was necessary and negotiated the terms and area to be covered by a federal body.[127] However, no law exists to establish such a body and ongoing disagreements over license revenue-sharing have stymied its development. As a result, licenses are still being issued ad hoc from multiple sources. This lack of clarity on licensing makes it difficult for foreign vessels to fish legally in Somali waters. It also opens the door for IUU fishers to take advantage of ambiguous regulations. Finally, there is still no effective enforcement capacity to monitor Somali waters for illegal vessels and activities.

Piracy is not an inevitable reaction to foreign fishing. With the right incentives, resources, and political will and commitment, Somali communities could develop community-based solutions to these problems, such as local management of marine resources or a system for monitoring and reporting suspicious foreign fishing vessels. Given Somalia's increased stability and the continued decline in the number of piracy attacks, the international community is beginning to invest in coastal communities with the intention of developing fisheries-based livelihoods. These investments must be sustainable and promote the long-term goals of stabilizing the economy and promoting food security in the Somali coastal regions. Short-term investments in resources that become quickly depleted will only exacerbate local frustration at the inability of local, national, and international actors to provide a prosperous future, and prior resentments may resurface. Finally, these investments will fail if illegal fishing is allowed to continue without a response by Somali authorities and the international community.

5. OUR ASSESSMENT OF SOMALI FISHERIES

This report consolidates existing information on Somali fisheries, debuts new data and analysis of fishing in Somali waters, and presents recommendations on the way forward that prioritize the sustainability of fisheries and profit to Somali people. In Chapter 2, we present new and original estimates of foreign fishing in Somali waters using data from public records, published media, surveys of Somali fishers, and satellite tracking of fishing vessels. We also estimate the amount of revenue Somalia could earn from licensing foreign vessels targeting HMS in their waters. In Chapter 3, we describe the domestic fishery through value chain summaries of important fisheries and we estimate the economic value of Somali fishing sectors. In Chapter 4, we calculate the amount of fish that could be harvested at sustainable levels in Somali waters, and we compare that to current levels of catch (both foreign and domestic). We also classify the sustainability of key fish stocks in Somali waters. Finally, in Chapter 5, we highlight opportunities for changes in governance, both in Somalia and within international bodies, that will encourage policies and structures to combat IUU fishing, promote a foundation for sustainable fisheries management, and create a stronger international effort to stop destructive fishing practices by foreign vessels in Somali waters.

REFERENCES

1. Somalia: Fishermen protest against illegal fishing. (2015, March 17). *Horseed Media*. Retrieved from http://horseedmedia.net/2015/03/17/somalia-fishermen-protest-against-illegal-fishing/
2. Somalia: Puntland describes illegal fishing as "national disaster." (2014, June 2). *RBC Radio*. Retrieved from http://www.raxanreeb.com/2014/06/somalia-puntland-decribes-illegal-fishing-as-national-disaster/
3. Agulhas and Somali Current Large Marine Ecosystems Project. (2010). *Coastal Livelihoods in the Republic of Somalia*. Retrieved from http://www.dlist.org/sites/default/files/doclib/Somalia%20Annex%20XI%20CLA%20final%20draft%2022-11-2010.pdf
4. Stromme, T. (1984). Cruise Report R/V "Dr. Fridtjof Nansen": second fisheries resource survey north-east coast of Somalia 24–30 August 1984. *Reports on Surveys with the R/V Dr Fridtjof Nansen*. Bergen, Norway: Institute of Marine Research.
5. Njoku, R.C. (2013). *The History of Somalia*. California: Greenwood.
6. Ibid.
7. Ibid.
8. Zapata, M. (2012, January 31). Somalia: Colonialism to independence to dictatorship, 1840–1976. *Enough 101*. Retrieved from http://www.enoughproject.org/blogs/somalia-colonialism-independence-dictatorship-1840-1976
9. Fact File: East African Campaign 19 January to 27 November 1941. (2014). In *BBC-WW2 People's War*. Retrieved from http://www.bbc.co.uk/history/ww2peopleswar/timeline/factfiles/nonflash/a1057547.shtml
10. Zapata, Somalia: Colonialism to independence
11. Somalia profile–Timeline. (2015, 5 May). *BBC News*. Retrieved from http://www.bbc.com/news/world-africa-14094632
12. Zapata, Somalia: Colonialism to independence
13. Lovatelli, A. (1996). *Artisanal Fisheries Final Report*. European Commission Rehabilitation Programme for Somalia. Nairobi, Kenya.
14. Zapata, M. (2012, February 7). Somalia: Challenges to dictatorship through Black Hawk Down, 1976–1990s. *Enough 101*. Retrieved from http://www.enoughproject.org/blogs/somalia-challenges-dictatorship-through-black-hawk-down-1976-1990s
15. Somalia profile–Timeline
16. James, G. (1995, January 3). Somalia's overthrown dictator, Mohammed Siad Barre, is dead. *The New York Times*. Retrieved from http://www.nytimes.com/1995/01/03/obituaries/somalia-s-overthrown-dictator-mohammed-siad-barre-is-dead.html
17. Somalia profile–Timeline
18. Arky, A. S. (2010). *Trading nets for guns: the impact of illegal fishing on piracy in Somalia* (Master's thesis). Naval Postgraduate School, Monterey, California.
19. United Nations Security Council Resolution 1744. (2007, February 21). UN Doc S/RES/1744. Retrieved from http://www.un.org/en/ga/search/view_doc.asp?symbol=S/RES/1744(2007)
20. Somalia profile–Timeline
21. Ibid.
22. Ibid.
23. Plaut, M. (2013, September 3). Kenya and Ethiopia help to dismember Somalia. *The New Statesman*. Retrieved from http://www.newstatesman.com/africa/2013/09/ethiopia-and-kenya-help-dismember-somalia
24. Aweis, D. (2015, February 9). Communiqué on FGS and regional states meeting in Mogadishu. *AllAfrica.com*. Retrieved from http://allafrica.com/stories/201502092415.html
25. Somali Maritime Code (Legislative Decree 1 of 21 Feb 1959). Mogadishu, Somalia. Retrieved from https://somaliswiss.files.wordpress.com/2011/10/somali-maritime-code-21-03-19591.pdf
26. International Maritime Organization. (2014). IMO Workshop on Maritime Somalia: Second joint workshop to discuss the establishment of a Somali maritime administration & review of Somalia Maritime Code. Addis Ababa.
27. Somali Democratic Republic Fishery Law No. 23 of 30 November 1985. (1985, November 30). Retrieved from http://faolex.fao.org/cgi-bin/faolex.exe?rec_id=003180&database=faolex&search_type=link&table=result&lang=eng&format_name=@ERALL
28. Somali Democratic Republic Ministry of Fisheries and Marine Resources. (1985, April 1). Guidelines for fisheries joint venture with foreign partners. Retrieved from http://faolex.fao.org/docs/pdf/som2144.pdf
29. Federal Republic of Somalia Ministry of Natural Resources. (2014). A Review of the Somali Fisheries Law (Law No. 23 of November 30, 1985), in accordance with Article 79, paragraph (d) of the Federal Constitution of Somalia.
30. Puntland govt bans lobster trade. (2014, September 17). *Garowe Online*. Retrieved from http://www.garoweonline.com/page/show/post/381/somalia-puntland-govt-bans-lobster-trade
31. M. Awale (personal communication, May 19, 2015).
32. Somali Maritime Resource & Security Strategy Fisheries Working Group. (2014, April 6). Communique of the Somali MRSS Fisheries Working Group. Beau Vallon, Seychelles. Retrieved from http://oceansbeyondpiracy.org/sites/default/files/attachments/Apr%206%20Somali%20Fisheries%20Working%20Group%20Communique_0.pdf
33. Government of Somaliland Ministry of Fisheries and Coastal Development. Fisheries Regulations of Somaliland Law No. 24 of 27 November 1995. Retrieved from

http://www.somalilandlaw.com/somaliland_fishery_law.html

34. The Federal Republic of Somalia Ministry of Natural Resources, A Review of the Somali Fisheries Law

35. African Development Solutions. (2015). *Illegal Unreported and Unregulated (IUU) Fishing in the Territorial Waters of Somalia*. Nairobi, Kenya.

36. UN General Assembly. (10 December 1982). *Convention on the Law of the Sea* (Agreement relating to the implementation of part XI of the convention). Retrieved from http://www.un.org/depts/los/convention_agreements/texts/unclos/closindx.htm

37. UN General Assembly. (2014, July 3). *Convention on the Law of the Sea* (Maritime Zone Notification M.Z.N.106.2014.LOS). Retrieved from http://oceansbeyondpiracy.org/sites/default/files/attachments/Somali%20EEZ%20Declaration.pdf

38. J. Million (personal communication, July 4, 2014).

39. Anon. (2014, August 8.) Republic of Somaliland protests moves by Somalia to encroach on maritime boundaries. *Somali Diaspora News*. Retrieved from http://www.qurbejoog.com/2014/08/08/republic-of-somaliland-protests-moves-by-somalia-to-encroach-on-maritime-boundaries/

40. McClanahan, T. R. (1988). Seasonality in East Africa's coastal waters. *Marine Ecology Progress Series*, *44*, 191–199. doi:10.3354/meps044191

41. Bakun, A., Roy, C., & Lluch-Cota, S. (1998). Coastal Upwelling and Other Processes Regulating Ecosystem Productivity and Fish Production in the Western Indian Ocean. In K. Sherman, E. N. Okemwa, & M. J. Ntiba (Eds.), *Large Marine Ecosystems of the Indian Ocean: Assessment, Sustainability, and Management* (pp. 103–141). Blackwell Science. doi:10.1016/s1570-0461(05)80025-4

42. Sommer, C., Schneider, W., & Poutiers, J.-M. (1996). *The Living Marine Resources of Somalia*. Rome: FAO.

43. Kotb, M., Abdulaziz, M., Al-Agwan, Z., Al-Shaikh, K., Al-Yami, H., Banajah, A., … Zajonz, U. (2004). Status of Coral Reefs in the Red Sea and Gulf of Aden in 2004 (pp. 137–154). In C. Wilkinson (Ed.), *Status of coral reefs of the world: 2004*, Volume 1. Australian Institute of Marine Science: Townsville, Queensland, Australia.

44. Pilcher, N., & Krupp, F. (2000). *The Status of Coral Reefs in Somalia–2000*. Global Coral Reef Monitoring Network. Retrieved from http://www.reefbase.org/resource_center/publication/main.aspx?refid=12547

45. Bihi, A. I. (1984). *L ' impact potentiel des activites socio-economiques sur l ' environne- ment marin et c6tier de la region de l ^ Afrique de l ' Est : Rapports nationaux*. Mers Regionales. Programme des Nations Unies Pour L'Environment, pp. 1–17.

46. Bakun et al., Coastal Upwelling

47. National Oceanographic and Atmospheric Administration, National Climatic Data Center. (1995). Regional Perspectives: Indian Ocean. In *State of the Reefs*. Retrieved from https://www.ncdc.noaa.gov/paleo/outreach/coral/sor/sor_indian.html

48. Persson, L., Lindop, A., Harper, S., Zylich, K. and Zeller, D. (2015). Failed state: reconstruction of domestic fisheries catches in Somalia 1950–2010. Pp. 111–127. In F. Le Manach and D. Pauly (Eds.) *Fisheries catch reconstructions in the Western Indian Ocean, 1950–2010*. Fisheries Centre Research Reports 23(2). Fisheries Centre, University of British Columbia [ISSN 1198–6727].

49. Sommer et al., *The Living Marine Resources of Somalia*

50. Bakun et al., Coastal Upwelling

51. Sommer et al., *The Living Marine Resources of Somalia*

52. Froese, R. & Pauly, D. (Eds.). (2015). FishBase. World Wide Web electronic publication. www.fishbase.org

53. Cury, et al. (2000). Small pelagics in upwelling systems: patterns of interaction and structural changes in "wasp-waist" ecosystems. *ICES Journal of Marine Science*. 57:603–618. doi:10.1006/jmsc.2000.0712

54. Fielding, P. J., & Mann, B. Q. (1999). *The Somalia Inshore Lobster Resource: A survey of the lobster fishery of the north eastern region (Puntland) between Foar and Eyl during November 1998*. Nairobi : IUCN EARO.

55. Johnsen, T. (1985). *Commercial trawling for fish and deep sea lobster (Puerulus spp.) off Somalia*. Available at http://www.fao.org/docrep/field/255099.htm

56. CIA World Factbook. Somalia. https://www.cia.gov/library/publications/the-world-factbook/geos/so.html. Accessed 29 July 2015.

57. Agulhas and Somali Current Large Marine Ecosystems Project, *Coastal Livelihoods*

58. Johnson, R. L. (1956). *Fisheries Reconnaissance Somalia, East Africa*. Rome: United States of America Operations Mission to Italy.

59. Carmichael, T. (1995). Somalia: A Country Study, 4th ed. (review). Northeast African Studies, 2(2), 189–190. doi:10.1353/nas.1995.0023

60. Haakonsen, J. M. (1983). Somalia's Fisheries Case Study. In *Case Studies and Working Papers Presented at the Expert Consultation on Strategies for Fisheries Development* (pp. 170–184). Rome: FAO.

61. Somali Democratic Republic. Law No. 40 of 4 October 1973 on Cooperative Development in the Somali Democratic Republic. Retrieved from http://www.ilo.org/dyn/natlex/natlex4.detail?p_lang=en&p_isn=88095

62. Haakonsen, J. M. (1984). Chapter V: The fishing cooperatives for resettled nomads. In *Scientific Socialism and Self-reliance: The case of Somalia's "Instant" Fishermen* (pp. 102–166). Bergen: University of Bergen.

63. United Nations Environment Programme. (1987). Coastal and marine environmental problems of Somalia (UNEP Regional Seas Reports and Studies No. 84).

64. United Nations Environment Programme. (2005). *National Rapid Environmental Desk Assessment-Somalia*.

65. Food and Agriculture Organization of the United Nations. (2005). *FAO Post Tsunami Assessment Mission to Central and South Coast of Somalia* (OSRO/SOM/505/CHA). Rome: Burale, D. M.
66. Government of Somaliland Ministry of Trade and Investment. (2014). *An Investment Guide to Somaliland Opportunities and Conditions 2013–2014*. Retrieved from http://somalilandinvest.net/somaliland_investment_guide.pdf
67. Food and Agriculture Organization of the United Nations. (2013). *Fact Sheet: Somalia Fisheries*.
68. United States Agency for International Development (2014). *Somalia Economic Growth Strategic Assessment: Final Assessment Report*. Washington, DC: Hadley, S., & Sharmarke, F.
69. Lovatelli, *Artisanal Fisheries*
70. S. Akester (personal communication, 13 July 2015)
71. Johnsen, *Commercial trawling*
72. Food and Agriculture Organization of the United Nations, *FAO Post Tsunami Assessment*
73. African Union Mission in Somalia. 2013 *Sector II Profile: Kismayo*. Retrieved from http://amisom-au.org/wp-content/uploads/2013/11/Sector-II-Kismayo.pdf
74. Food and Agriculture Organization of the United Nations. (1985). *Somalia technical assistance for marketing and cooperatives*. Rome: Elmer, S.
75. Kulmiye, A. (2010). *Assessment of the status of the artisanal fisheries in Puntland through value chain analysis*. Available at http://shuraako.org/sites/default/files/documents/Assessment%20of%20the%20Status%20of%20the%20Artisanal%20Fisheries%20in%20Puntland%20Through%20Value%20Chain%20Analysis.pdf
76. Somali Democratic Republic Ministry of Fisheries and Marine Transport. (1988). *Yearly Fisheries & Marine Transport Report*. Mogadishu, Somalia.
77. The World Bank. (1992). *Project Completion Report, Somalia Fisheries Exploration/Pilot Project* (Report No. 10983, CR. 1465-SO). Washington, DC.
78. Lovatelli, *Artisanal Fisheries*
79. Food and Agriculture Organization of the United Nations, *FAO Post Tsunami Assessment*
80. Government of Somaliland Ministry of Trade and Investment, 2014, *An Investment Guide to Somaliland*
81. Ibid.
82. Somali Democratic Republic, Guidelines for fisheries joint venture
83. Haakonsen, Somalia's Fisheries Case Study
84. Van Zalinge, N. P. (1988). *Summary of fisheries and resources information for Somalia*. Rome: FAO.
85. Bihi, *L 'impact*
86. Ibid.
87. Somali Democratic Republic, Guidelines for fisheries joint venture
88. Library of Congress, *Somalia: A Country Study*
89. Haakonsen, Somalia's Fisheries Case Study
90. United Nations Environment Program, *Coastal and marine environmental problems of Somalia*
91. Somali Democratic Republic, Guidelines for fisheries joint venture
92. Johnsen, *Commercial trawling*
93. Van Zalinge, *Summary of fisheries*
94. Yassin, M. (1981). *Somalia: Somali Fisheries Development and Management*. Retrieved from www.mbali.info/doc278.htm
95. Hariri, K. I., Nichols, P., Krupp, F., Mishrigi, S., Barrania, A., Ali, A. F., & Kedidi, S. M. (2002). *Status of the Living Marine Resources in the Red Sea and Gulf of Aden and Their Management*. Strategic Action Programme for the Red Sea and Gulf of Aden.
96. SHIFCO. (1998, November 18). *Final Mission Report, Somalia*. Retrieved from http://ec.europa.eu/food/fs/inspections/vi/reports/somalia/vi_rep_soma_1522-1998_en.pdf
97. The World Bank. (2006, January 11). *Somalia–From Resilience Towards Recovery and Development* (Report No. 34356-SO).
98. Johnsen, *Commercial trawling*
99. The World Bank. (1992). Project completion report—Somalia fisheries exploration/pilot project (Report No. 10983, Cr. 1465-SO).
100. Van Zalinge, *Summary of fisheries*
101. Somali Democratic Republic, Guidelines for fisheries joint venture
102. Meyers, R.J., Murrell, K.L. (1986). Divestiture of Somali marine products privatization in Somalia. New York: USAID.
103. Somali Ministry of Fisheries, *Yearly Fisheries & Marine Transport Report*
104. Lovatelli, *Artisanal Fisheries*
105. Ibid.
106. Mareeg Media. (2008, November 16). Official pirate-fishing in the Somali Indian Ocean flourishing. *Mareeg.com*. Retrieved from http://www.mareeg.com/fidsan.php?sid=8987&tirsan=3&PHPSESSID=a7d1aaf50bb2cb3b29ae23d0bfa189b2
107. Ibid.
108. Somalinet Forums. (2011, April 16). *Fishing Sector in Puntland: Fishing Companies*. Retrieved from http://www.somalinet.com/forums/viewtopic.php?f=246&t=274548
109. Rumley, D., Chaturvedi, S., & Sakhuja, V. (Eds.). (2009). *Fisheries Exploitation in the Indian Ocean*. Pasir Panjang,

Singapore: ISEAS Publishing. doi:10.1080/19480881.2010.536679

110. Haakonsen, Chapter V
111. Oceans Beyond Piracy. (2014). *The State of Maritime Piracy Report 2014*. Denver, Colorado: One Earth Future Foundation.
112. Indian Ocean Tuna Commission. (2013). Examination of the effects of piracy on fleet operations and subsequent catch and effort trends. IOTC-2013-SC16-13[E].
113. Sumaila, U. R., & Bawumia, M. (2014). Fisheries, ecosystem justice and piracy: A case study of Somalia. *Fisheries Research*, *157*, 154–163. Retrieved from doi:10.1016/j.fishres.2014.04.009
114. Ibid.
115. Lehr, P. and Lehmann, H. (2007). Somalia – pirates' new paradise. In P. Lehr (Ed.), *Violence at Sea: Piracy in the Age of Global Terrorism* (pp. 1–22). New York, NY: Routledge. doi:10.4324/9780203943489
116. Kulmiye, A.J. (2001, July 9). Militia vs trawlers: who is the villain? *The East African Magazine*.
117. Sumaila, Fisheries
118. Somalia profile–Timeline
119. Food and Agriculture Organization of the United Nations, *FAO Post Tsunami Assessment*
120. Schbley, G., & Rosenau, W. (2013). *Piracy, Illegal Fishing, and Maritime Insecurity in Somalia, Kenya, and Tanzania*. Retrieved from https://www.cna.org/research/2013/piracy-illegal-fishing-maritime-insecurity-somalia
121. Oceans Beyond Piracy, *The State of Maritime Piracy*
122. Waldo, M. A. (2014, January 8). The two piracies: why the world ignores the other? *WardheerNews.com*. Retrieved from http://wardheernews.com/Articles_09/Jan/Waldo/08_The_two_piracies_in_Somalia.html
123. Oceans Beyond Piracy, *The State of Maritime Piracy 2014*
124. African Development Solutions, Illegal, Unreported, and Unregulated
125. Ibid.
126. Oceans Beyond Piracy *The State of Maritime Piracy 2014*
127. Somali Maritime Resource & Security Strategy Fisheries Working Group, 2014 Communique

CHAPTER 2. FOREIGN FISHING IN SOMALI WATERS

Fishing by Somalis is primarily an artisanal endeavor, and catch by domestic fisheries is fairly moderate —estimated to be between 29,800[a] mt and 65,000[b] mt in 2010 (see Chapter 3). Foreign vessels catch a significant amount of additional fish in Somali waters. Most catch by foreign vessels never directly benefits Somalis or the Somali economy. The following analysis demonstrates that in order to sustainably develop Somali fisheries beyond current levels, foreign fishing (both legal and illegal) must be limited, licensed, recorded, and regulated as soon as possible. If done properly, revenues gained from licensing foreign fishing can be invested and distributed to benefit Somali people, especially fishers.

Illegal, unreported, and unregulated (IUU) fishing in Somali waters has been problematic for decades.[1,2,3] During the 1990s, the specter of IUU fishing became an initial justification for pirate attacks on foreign fishing vessels.[4,5] The success of this piracy, and the ransoms received, encouraged attacks on merchant and private vessels in Somali waters. Piracy became such a risk that distant water fleets (DWF) targeting tuna and tuna-like species dramatically altered their fishing habits and effectively withdrew from Somali waters during the mid-2000s.[6] While piracy has declined due to the presence of foreign naval vessels and armed guards on merchant

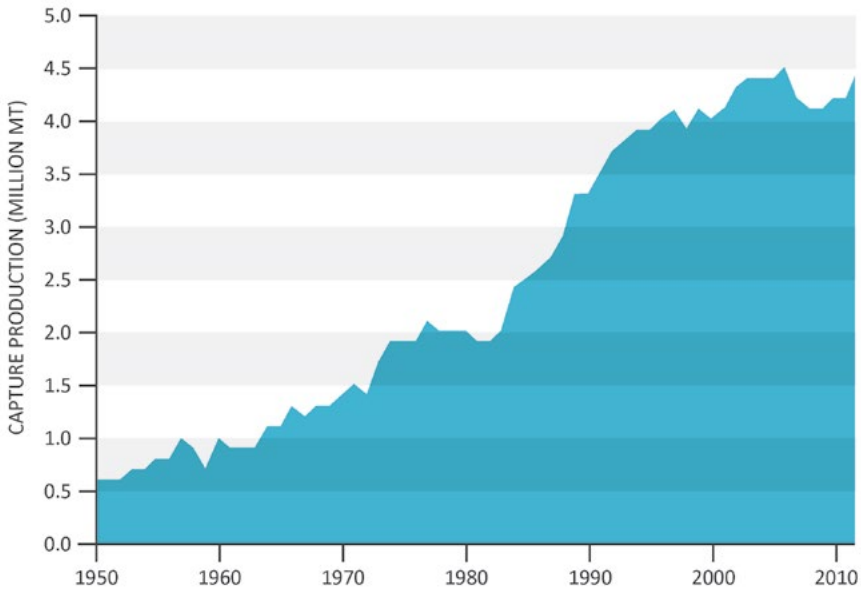
FIGURE 2.1 The Western and Eastern Indian Ocean, divided by FAO Area boundaries.

a Estimated by the UN FAO and listed in FishStatJ software. Accessed 30 July 2015.

b Estimated by the Sea Around Us. Available from www.seaaroundus.org. Accessed 28 July 2015.

vessels,[7] the continued presence of foreign fishing vessels within sight of the Somali coast is again galvanizing public anger.[8] This, in turn, risks greater public support of piracy (see Chapter 1 §4.5). Furthermore, the sustainable development of fisheries by Somalis is made significantly more difficult while foreign vessels operate with impunity. The imperative to reduce foreign IUU fishing in Somali waters is of immediate importance.

FIGURE 2.2 Marine capture production for the Western Indian Ocean as reported to the FAO.



1. THE CONTEXT: FISHING IN THE WESTERN INDIAN OCEAN

The Western Indian Ocean (WIO, Figure 2.1), congruent with UN Food and Agriculture Organization (FAO) Area 51, accounts for approximately 5.5% of global marine capture production.[9] Since around 2003, capture data reported to the FAO[c] for the WIO show stagnation between 4 and 4.5 million mt per year (Figure 2.2). By comparison, global capture production began to stagnate in the late 1980s,[10] suggesting that fisheries development in the WIO has lagged behind global development. Caution is needed when inferring trends from these data, however, because IUU fishing may mask the true patterns of fishing in the WIO. The recent plateau in capture from the WIO could be caused by stagnation in fisheries productivity or a decrease in reporting. If the former, there may be little room to increase annual capture beyond the current 4.5 million mt. Some have argued[11] that Somali waters represent an untapped source of fisheries potential given the low levels of domestic development. However, considering the extensive amount of foreign fishing within Somali waters we document in this report, and the high levels of IUU fishing in the WIO in general,[12] the capacity to increase fish catch in Somali waters may be limited.

Half of fisheries capture in the Indian Ocean comes from artisanal fleets. This creates significant data challenges across the region.[13] Small, artisanal fleets have characteristics that complicate fisheries data collection and hence management: many small boats, low governance capacity, dispersed and numerous landing sites, diverse market chains, multi-species and multi-gear fleets, and no clear distinction between target and bycatch species. Consequently, data quality varies widely, underreporting is widespread, and catch is rarely documented at the species level.

Today, India dominates fishing in the WIO (Table 2.1), accounting for almost 50% of all marine capture production reported to the FAO. The second ranked country, Iran, accounts for only 10% of the total. Somali marine capture production ranks seventeenth in the WIO according to these reported data.[d]

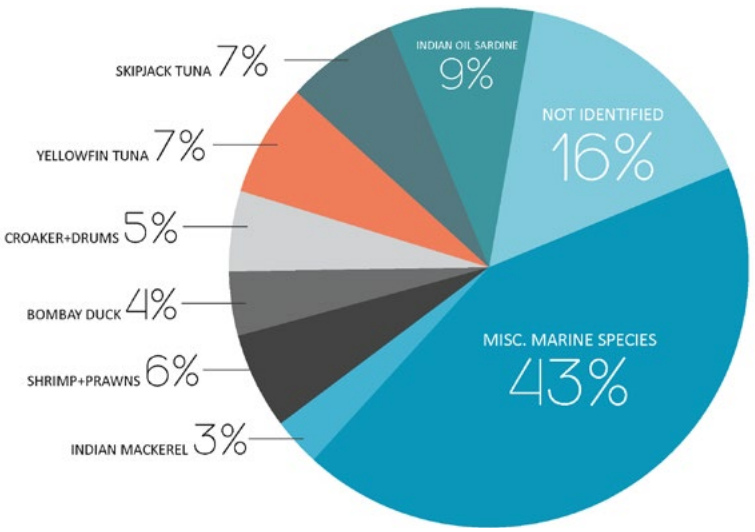
c Marine capture production reported to the FAO and listed in FishStatJ software. Accessed 19 June 2015 for data spanning 1950–2013. The FAO fisheries database is a commonly used source of global capture production, but the reliability of these data is questionable. Countries may misreport for various reasons: some nations have incentives to overreport in order to mask declining catches, some nations have incentives to underreport in order to obscure high levels of fishing pressure, and some nations lack data collection and management capacity, which hinders accurate reporting. Thus, the trends illustrated by these graphs must be understood in the context of uncertain reporting. This report illustrates the need for improved reliability of the data reported to the United Nations. See, for example, Pauly, D. and Zeller, D. (2003) The global fisheries crisis as a rationale for improving the FAO's database of fisheries statistics. Fisheries Centre Reports. 11(6). 9 pp.

d Since 1988, Somalia has not reported capture to the UN, so the FAO estimates capture based on prior years of reporting. The Sea Around Us has produced a reconstruction of Somali capture, by which they estimate 65,000 mt was caught in 2010. See Chapter 3 for details.

TABLE 2.1 Marine capture production for the Western Indian Ocean as reported to FAO in 2013.

Nation	Landings (mt)	% of total
India	2,180,030	47.7
Iran	473,658	10.4
Pakistan	351,748	7.7
Yemen	210,000	4.6
Oman	206,170	4.5
Spain	158,968	3.5
Mozambique	137,241	3.0
Maldives	129,842	2.8
Madagascar	81,434	1.8
Seychelles	73,905	1.6
United Arab Emirates	72,000	1.6
Saudi Arabia	71,947	1.6
Tanzania	67,422	1.5
Taiwan (Province of China)	66,329	1.5
France	65,754	1.4
Egypt	43,634	1.0
Somalia	29,800	0.7
Zanzibar	30,712	0.7
Republic of Korea	16,606	0.4
Bahrain	14,978	0.3
Qatar	12,006	0.3
All others	78,307	1.5
Total	4,572,491	100

FIGURE 2.3 Marine species caught in the Western Indian Ocean as reported to the FAO (summed over 2004-2013). The category misc. marine species includes 321 taxonomic groups, each 2% or less of total catch.



The top species captured in the Indian Ocean are Indian oil sardine (*Sardinella longiceps*, 9%), skipjack tuna (*Katsuwonus pelamis*, 7%), yellowfin tuna (*Thunnus albacares*, 7%), and Bombay duck (*Harpadon nehereus*, 4%) (Figure 2.3). The Indian artisanal fleet targets Indian oil sardine and Bombay duck lizardfish, whereas tuna and mackerel are targeted by most other fleets. Sixteen percent of all marine life caught in the WIO is unidentified, adding to the challenge of fully assessing the stocks of commercially important fishes.

2. THE PROBLEM OF IUU FISHING IN SOMALI WATERS

IUU fishing poses a serious threat to the ecological and economic sustainability of Somalia's marine fisheries and to the livelihoods of Somali coastal communities (Box 2.1).[14] In general, IUU fishing interferes with a nation's ability to meet fisheries management goals, reduces the profitability of its fisheries, and hastens the collapse of overfished stocks.[15]

In 2000, the FAO defined IUU fishing as follows:[16]

- *Illegal* fishing includes poaching (vessels fishing in territorial waters without permission to be there), failure to observe conservation and management measures, and fishing on the high seas in violation of the UN Convention on the Law of the Seas (UNCLOS).
- *Unreported* fishing involves any fishing that is not reported or is misreported to a relevant agency.
- *Unregulated* fishing includes fishing in areas where reporting is not mandated, where management does not exist or is not enforced, or where detailed knowledge of fishery resources is lacking.

All three components of IUU fishing exist in Somali waters. Determining how widespread *illegal* fishing has been in the past is difficult. Since passage of the Somali Fisheries Law[17] in December 2014, licenses previously issued to foreign vessels became null and void, and new licenses must be issued.[e] All bottom trawling, regardless of whether a vessel is flagged to Somalia or elsewhere, is

[e] Article 16

now illegal in Somali waters.[f] Finally, the first 12 nm of Somali waters are reserved for Somali fishers only.[g]

Prior to passage of the law, however, legality of foreign fishing was unclear. The Somali Maritime Code (see Chapter 1 §2) clearly mandated licenses for all foreign fishing vessels, and that provision applied to the 200 nm territorial sea claimed by Somalia in 1972. Despite the fact that Somalia's territorial waters claim occurred before UNCLOS, many nations challenged the validity of the claim and used it as an excuse to fish in Somali waters beyond 12 nm without license. Foreign vessels sometimes obtained licenses to fish from regional or local fishing authorities,[18] from local village or clan leaders,[19] and, in some cases, from warlords.[20] Licenses were frequently issued by parties with no legal authority to do so, and foreign vessels were either ignorant of or complicit in such activity. Widespread corruption around these licenses has been reported,[21] and in some cases license fees were exchanged for "protection" from pirates.[22] Some vessels

Box. 2.1: The Personal Side of IUU Fishing

Jama Mohamud Ali, Puntland

Mr. Jama Mohamud Ali has been in the fishing industry for over 24 years. He founded one of the largest fishing companies in Puntland, Corno Africa Fishing Company (CAFCO), with facilities in Bosaso and Bander Beyla. King fish, grouper, snapper, tuna, lobster, and sharks comprise the majority of the company's income. In addition to fishing, his company markets fresh fish, sells fuel to fishing boats, repairs outboard engines, and refills air tanks for lobster divers. He and his 74 employees have witnessed foreign fishing in their waters for years. He believes the problem is widespread and worsening. In his own words:

"The illegal fishing in Somalia's sea triggered huge destructive impacts on my daily life and that of my relatives. The illegal fishing vessels destroyed our fishing gear. On March 10, 2000 they overran two of my company's small fishing pots, completely destroying them. The men on my company's vessels were badly injured during this incident. Again on October 8, 2008, the illegal fishing vessels injured many of my company's fishermen by firing machine guns at them. The foreign vessels are extremely well-equipped with weapons that they use to prevent the local fishermen from using the fishing zones.

The illegal fishing in Somalia has tremendously reduced the fishing activities of local businesses, leading to low production. As a result, my business is facing difficulties. Our boats and gear are small and cannot go far out to sea. The fishermen fear the foreign illegal fishing ships will overrun them in the middle of the night, killing or seriously injuring them by firing their sophisticated armaments. These large, modern fishing vessels are depleting our catch. Our pots are set close to shore and even after letting them fish for days and nights, little or no fish is caught. Sometimes we cannot even pay the fishermen or the expenses for fishing gear. These large vessels are also dominating the export market. This is an enormous problem.

The illegal fishing initiated Somali piracy, which in turn affected the cost of daily life here. The price of commodities went up, which affected my business and daily life. There was also an effect on the water. The fishermen fear either the pirates or the anti-piracy forces. The anti-piracy forces are addressing the problem, but not the causes of piracy."

f Article 33
g Article 3

obtained what appeared to be legitimate licenses, but allowed those licenses to expire while continuing to fish. Vessels from some nations, such as Yemen, entered into arrangements with local fishers and authorities to trade fish or fishing rights for ice and fuel (Box 2.3).[23] Given the lack of a central authority, especially in fish-rich regions such as Puntland or Somaliland, such arrangements were made out of necessity and may not have been illegal. However, many vessels took advantage of the instability in Somalia and never attempted to obtain a fishing license from any authority.

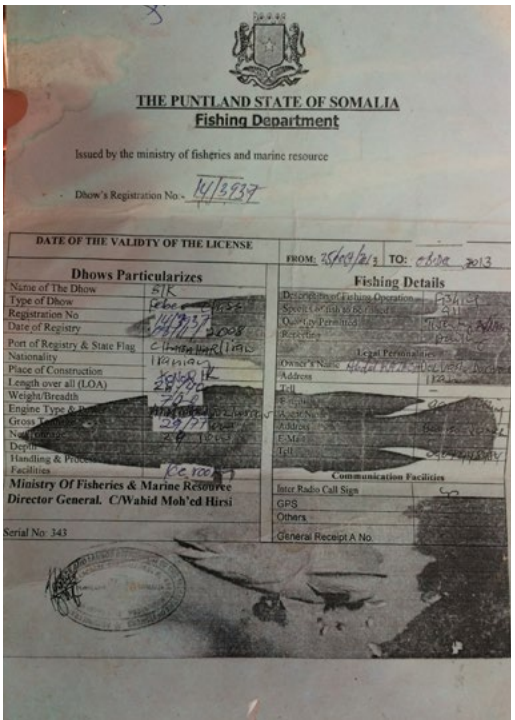
It is neither practical nor fruitful to retrospectively assign legal status to most fishing that has occurred in Somali waters. The past confusion over licensing authority demonstrates that ad hoc licensing without a robust regulatory framework in place is highly problematic. Recent progress has been made in putting such a framework in place. In April 2014, the Federal Government of Somalia (FGS), Somaliland, and the federal coastal states, under the Fisheries Working Group of the Somali Maritime Resource and Security Strategy (SMRSS),[24] signed a communiqué that gave the authority to license foreign demersal coastal fishing to the states and the authority to license foreign highly migratory species (HMS) fishing to the FGS. Federal and state authorities must still agree on a revenue-sharing system before further action can be taken.

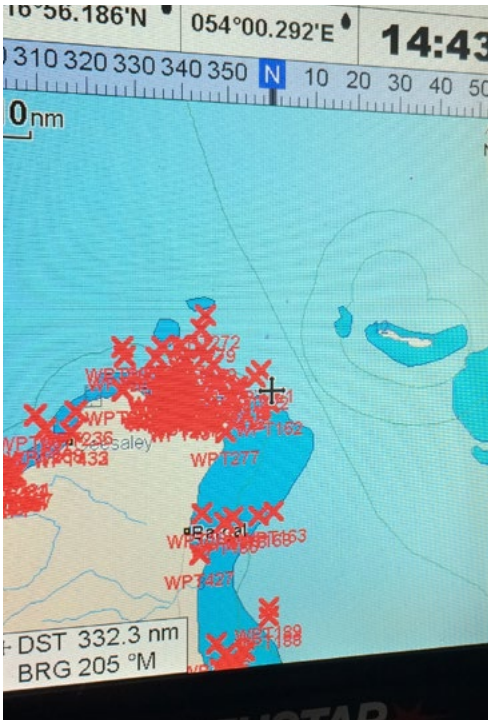
Much of the fishing in Somali waters is *unreported*. The FGS is not collecting nationwide domestic catch statistics, nor have they reported catch to the FAO since 1988. Recently, local efforts to report catch have been initiated. For example, fishers working for Somali Fair Fishing, an NGO operating in Berbera, have systematically reported their catch. However, there is an important need for a nationally or regionally coordinated attempt to report, archive, and analyze catches from domestic fisheries. Domestic and foreign vessels are now legally required[h] to report all catch, but there is not yet a mechanism by which this can be accomplished. For foreign vessels, flag state reporting mandates vary. Indian Ocean Tuna Commission (IOTC) Members or Non-Contracting Cooperating Parties are required to collect catch data from their vessels and to report it to the IOTC. However, vessels operating outside IOTC mandate, including trawlers, may not report catch to any agency. In particular, it is unclear whether vessels from Yemen report the catch they make while in Somali waters to any central authority.

Finally, for the past several decades, all fishing (foreign or domestic) in Somali waters has been *unregulated*. The management measures enacted during the 1980s have not been regularly or effectively enforced. Scientific surveys of Somali waters have not been conducted since the 1980s[25] and fishery data collection has been piecemeal. As a result, detailed knowledge about the fisheries is severely lacking. While much attention is given to illegal fishing, unregulated fishing is equally problematic for the ecological and economic sustainability of fish stocks.[26] Without resource assessments and management policies informed by sound science, unregulated fishing can lead to resource depletion and collapse.[27] This can happen without warning as a consequence of poor monitoring. While some foreign vessels may be able to relocate their fishing effort to overcome local depletions of fishes, Somali fishers have no such capacity.

The failure to implement and enforce a national, comprehensive approach to licensing foreign vessels has resulted in the widespread perception[28] in Somalia that all foreign boats are fishing illegally. This, in turn, has galvanized the Somali public's resentment against foreign

Left: expired fishing license; right: locations fished under expired license, Andy Hickman





h Somali Fisheries Law, Article 24.

vessels. This anger is not unwarranted. Foreign vessels have been accused of hiring armed guards and shooting at Somali fishers,[29] spraying Somalis with hot water, destroying artisanal fishing gear (Box 2.1), depleting fish stocks at the expense of domestic catch, and destroying coral reef habitat. Regardless of the technical definition of illegal fishing, Somalis experience the negative impacts of rampant foreign fishing whether it is legal or not.

An uptick in public anger at foreign fishing has had consequences for foreign fishing vessels. Vessels that were once allowed to fish freely, often under legal arrangements, have recently lost that right. For example, Egyptian trawlers that had been licensed to fish in Somaliland are now subject to inspection and have even been arrested.[30] Piracy, which in 2014 was almost eliminated, may be resurging; two Iranian fishing vessels were captured in March 2015 and as of this writing 19 of these fishers are being held in Somalia.[31] In May 2015, another Iranian vessel thought to be fishing illegally ran out of fuel and drifted onto shore in El-Dheer, an Al Shabaab stronghold.[32] After paying a "fishing fee," the crew and cargo were released. In addition, 26 fishers on the highjacked *Naham 3* have been held hostage since 2012.

Somali authorities have asked for international cooperation to fight back against illegal foreign fishing. In April 2015, the Somali delegation to the annual IOTC meeting[i] documented[33] specific occurrences of illegal fishing in its waters. They presented evidence, including vessel tracks and photographs, of illegal fishing by four Iranian gillnetters (the FVs *Aresh, Siraj, Jabber*, and an unknown vessel). At least one of these had an altered (and expired) license on board. At least nine Chinese longline vessels were operating illegally in Somali waters during March and April 2015.[j] And a long battle against foreign trawlers continues. The Somali delegation named four trawlers that were formerly flagged to South Korea and that have been operating close to shore since 2006 (see §4 below). Two additional trawlers, both with Korean origins,[34] have been operating illegally throughout 2015.[k] It appears these vessels were recently allowed to leave port in Mogadishu with a cargo of fish,[35] but there was an attempt to have the trawlers inspected when they landed in Mombasa, Kenya. Somali authorities were successful at preventing one of these trawlers from unloading cargo in Salalah, Oman by imploring Oman to invoke the Port State Measures Agreement, to which they are a signatory.[l] The agreement allows ports to deny entry to vessels believed to have engaged in IUU fishing. That trawler appears to have landed its cargo in Yemen, while the other successfully unloaded in Oman after presenting a license from Puntland.

Tuna on suspected illegal vessel from Iran, Andy Hickman

Below, we reconstruct the levels of foreign fishing occurring in Somali waters to the best of our ability based on the data available. We choose not to put a precise number on illegal versus legal foreign vessels in Somali waters because the designations are too individualized and contextualized, as explained above. Rather, understanding that all foreign fishing in Somali waters is unregulated, most of it is unreported to Somali authorities, and unknown amounts of it are illegal, we posit that knowing the exact numbers of illegal vessels is not necessary. IUU fishing is a significant, urgent, and ongoing threat to the sustainability of Somali fisheries. Political will by Somali politicians, the international community, and within fishing communities is needed in order to overcome these challenges. There has been real progress towards adopting national legislative instruments that can address IUU fishing, but they need to be implemented and respected by foreign vessels to be effective. Given the tenuous state of commercially important fish stocks in Somali waters (see Chapter 4), the next 7 to 10 years will be a critical period for the international and Somali communities to take immediate steps to stop IUU fishing in Somali waters.

i Nineteenth Session of the Indian Ocean Tuna Commission, 27 April–1 May 2015, Busan, Korea.

j The Chinese delegation to the IOTC took swift action and their vessels left Somali waters immediately thereafter. There were reports in June 2015 that at least some of these nine vessels had returned under license by the Federal Government.

k These are two of the same trawlers we have included in our AIS analysis of trawling. See §4.

l As of June 12, 2015, two of these vessels were spotted (from AIS on ShipView) in Yemeni waters.

Box 2.2: How IUU Vessels Avoid Detection

IUU fishing is a significant problem around the globe, not just in Somali waters. The value of fish that IUU vessels pursue far outweighs whatever consequences they might incur if caught poaching.[36] Governments are implementing increasingly harsher penalties meant to deter IUU fishing, and while there are international statutes targeted at reducing illegal fishing, loopholes remain that allow vessels to avoid detection while they are conducting illicit activities.

The increasing geographic footprint of the global distant water fishing fleet means vessels can travel far from their home ports to plunder the waters of countries, like Somalia, that have weak governance, poor law enforcement, or minimal monitoring, control, and surveillance (MCS). Many developing countries lack sufficient capacity to detect, deter, or prosecute IUU vessels, making their fish stocks desirable targets.

Ships use a variety of methods to avoid detection during and after IUU activities.

- *Flags of convenience:* A vessel may use a flag from a country different from that of the vessel's beneficial owner in order to obscure its identification and to avoid penalties for IUU fishing. Notoriously, some nations are known to sell their flags, and vessels shop around for nations that offer the least oversight and fewest regulations at the best price. This is often called a "flag of convenience" or "flag of non-compliance."[37]

- *Concealment of physical identifiers:* Vessels cover or obscure their names and identification numbers, making it difficult for others to report suspicious activities.

- *Tampering with Automatic Identification System (AIS) signals:* AIS is not a tamper-proof system. The broadcast information is easily adjusted to mask vessel identity.[38] Tactics include:

    - Completely disabling the AIS unit during illicit activities
    - Using generic Maritime Mobile Service Identity (MMSI) and International Maritime Organization (IMO) identification numbers or using numbers that belong to other vessels
    - Not listing an IMO number at all
    - Changing the radio call sign
    - Adjusting latitude and longitude coordinates to show a location different from where fishing actually occurred

- *Port avoidance:* There are many regulations in place to prevent IUU fish from entering global markets, most notably the Port State Measures Agreement. To avoid compliance with such measures, boats will avoid ports during offloading. A transport (reefer) vessel will meet the fishing vessel on the water and the fish will be transferred to the transport vessel, often mixing illegal fish with legally captured fish and making the illegal fish undetectable in the market.[39]

- *Catch non-reporting:* Flag of convenience vessels undermine fishery conservation measures by exceeding regional quotas because they often lack a mandate to report catch to the flag state

As a reaction to these practices, there has been a push to increase the liability for IUU activities of boat owners and the countries in which they reside, rather than the flag state. However, vessel ownership is often hidden behind complicated and deceptive business arrangements, making it difficult to enforce such laws.[40,41] It is crucial for the international community to close legal loopholes that allow IUU fishing to flourish around the world.

3. ESTIMATING FOREIGN FISHING IN SOMALI WATERS

While foreign fishing in Somali waters has been problematic for at least the past two decades,[42] the lack of reporting and monitoring means that little data is available to quantify the problem. A systematic assessment of foreign fishing in Somali waters has never been done until now. Here, we combine a variety of methods to estimate the volume of fish removed from Somali waters by foreign fleets. As discussed, we do not distinguish foreign vessels fishing legally from those fishing illegally in Somali waters. Rather, our goal is to estimate the total volume of fish catch from Somali waters since the early 1980s by boats not flagged to Somalia.

3.1 Methods for Estimating Foreign Fishing in Somali Waters

We used four approaches to estimate fishing by foreign vessels: (1) analysis of fish catch reported to the IOTC, (2) catch reconstruction using data found in scientific and media reports, (3) analysis of AIS vessel broadcast data that have date, time, and location stamps, and (4) catch allocation estimates published by the Sea Around Us. Where available, we supplemented these data with information on catch composition. For a given fishing nation, the approach chosen was dependent on the type, quality, and duration of data available. Following an established method for estimating IUU fishing outlined by Pitcher et al.,[43] we began our analysis by creating a detailed fishery timeline[m] through extensive searches of the literature, expert interviews, and conversations with Somalis (Appendix 1). We started our estimation in 1981, based on our review of the literature and available data, which show that foreign fishing in Somali waters began to increase in earnest during the early 1980s. We do not make estimates for 2014 or 2015 due to a lack of consistent data: IOTC data run through 2013, AIS data run through 2014, and Sea Around Us data run through 2010. Appendix 2 provides detailed methodologies for the approaches used to estimate catch for each country.

Analysis of IOTC data

Nations that are Members or Non-Contracting Cooperating Parties of the IOTC are required to submit annual records that describe the number and/or volume of fish species caught (nominal catch data), the amount of fishing effort (e.g., hours fished), the gear used, and the date and location of the catch (catch and effort data). These reporting requirements apply only to the 16 species[n] under IOTC mandate plus commonly caught shark species.[44] The IOTC makes these data available on its website,[o] and the catch-and-effort data are available in three sets: from longline vessels, from purse seine vessels, and from coastal vessels (e.g., gillnets or handlines). We estimated catch by IOTC-reporting nations in Somali waters[p] based on the latitude and longitude reported with catches.

Appendix 2 provides details of our analysis of IOTC catch and effort data. Briefly, we overlaid a 1°×1° grid (for the purse seine dataset) and a 5°×5° grid (for the longline and coastal datasets) onto the boundaries of Somali waters. Catch in 1° cells that overlapped Somali waters or touched the boundary line was assigned 100% to Somali waters. Catch in 5° cells that overlapped Somali waters was disaggregated by the proportion of the cell that overlapped. For example, if a 5° cell fell half in and half out of Somali waters, the catch reported for that cell was assigned 50% "in" and 50% "out" of Somali waters.

This approach introduces uncertainty to the estimates of IOTC-reported catch assigned to Somali waters. Our disaggregation assumes an equal likelihood of catch at any point in a grid cell. However, it is possible that none (or all) of the catch in a given 5° cell occurred in Somali waters. We urge the IOTC and its members to report all longline data at a finer (1°×1°) resolution to reduce the uncertainty associated with locating fishing activities in the Indian Ocean.

Catch reconstruction

We modeled our reconstruction approach after that developed by Pauly et al.[45] to estimate the volume and patterns of catch by the Chinese distant water fishing fleet. Our modified approach was as follows: (1) establish

m Available from http://securefisheries.org/report/securing-somali-fisheries

n Albacore, skipjack, yellowfin, southern bluefin, longtail, kawakawa, bullet, frigate, and bigeye tunas; swordfish, black marlin, blue marlin, striped marlin, Indo-Pacific sailfish, Indo-Pacific king mackerel, and narrow-barred Spanish mackerel.

o Available from http://www.iotc.org/data/datasets, downloaded on December 9, 2014.

p Somali waters were defined by the EEZ boundaries submitted to the United Nations in July 2014. http://www.un.org/Depts/los/LEGISLATIONANDTREATIES/PDFFILES/SOM_2014_EEZ.pdf Secure Fisheries understands and respects disagreement about these boundaries, but we use them because they provide concrete boundaries for mapping and analysis purposes.

Tuna caught in Somali waters, Andy Hickman

the presence of a given nation's vessels in Somali waters from available literature and expert input; (2) estimate the likely number of vessels flagged to a given nation that are fishing in Somali waters for years in which data are available; (3) use various records of catch (e.g., catch rate or vessel capacity) and species composition to estimate total catch amount and type by fishing vessels of a given nation for years in which data are available; (4) extrapolate catch amount between years for which data exist (anchor points) to years for which data do not exist; (5) generate 95% confidence intervals for our estimates of catch as a measure of uncertainty (a Monte Carlo simulation) based on ranges of vessel numbers and catch amounts. Methods varied slightly from country to country given available information. See Appendix 2 for country-specific details.

Analysis of satellite-based AIS data

AIS is a vessel tracking system used by ocean-going vessels for collision avoidance, tracking, and identification. Signals are broadcast from vessels and intercepted by ship, land-based station, or satellite-based receivers. The IMO mandates that all vessels 300 gross tonnage or larger, and all passenger vessels, be equipped with AIS for safety. Fishing vessels are not required to broadcast AIS, although many larger vessels do so voluntarily. We obtained AIS data[q] for a set of foreign trawlers operating in Somali waters from July 2010 through December 2014. These seven trawlers were flagged to South Korea during that period. Using speed over ground from AIS broadcasts, we estimated the trawlers' locations and days spent trawling. We then matched estimates of days spent trawling to reports of volume and composition of fish caught during seven fishing campaigns of various lengths (between 20 and 27 days each). These catch reports were obtained from three of the seven trawlers. See Appendix 3 for details.

Allocation of catch using Sea Around Us algorithms

We used catch allocated to Somali waters by the algorithms[46] developed by the Sea Around Us to estimate catch by Pakistan. These estimates of catch were obtained from their publicly available online datasets.[r] Sea Around Us assigned foreign catch to Somali waters by: (1) estimating total catch for a given foreign nation using FAO catch statistics; (2) overlaying species' geographical distributions with Somalia's EEZ; and (3) including consideration of any access agreements between Somalia and the foreign fleet.

3.2 Results: Estimates of Foreign Fishing in Somali Waters since 1981

Between 1981 and 2013, we estimate that foreign vessels fishing in Somali waters landed approximately 3,100,000 mt of marine life (Table 2.2 and Figure 2.4). In comparison, reconstruction of Somali domestic catch is only 1,404,125 mt over the same time period.[s] In the most recent year analyzed (2013), we estimate annual catch by foreign vessels was 132,000 mt while Somali artisanal catch was only 40,000 mt per year, less than one-third that of foreign catch. Foreign catch peaked at 193,000 mt in 2003 as regional fleets (primarily from Iran and Yemen) became firmly established, but before the peak of pirate activity caused IOTC vessels fishing for HMS to avoid Somali waters.[47] Today, Iran and Yemen are by far the dominant foreign presence in Somali waters.

Our estimates are bolstered by informal interviews in early 2015 with Somali fishers and fish processors in Puntland and Somaliland (see Appendix 1). When asked, "What country do the foreign fishers come from?" 33 respondents listed the following nations (listed in descending order of the number of times a country was mentioned): Yemen, Iran, South Korea, India, Seychelles, Thailand, Egypt, Taiwan (Province of China), Pakistan, Spain, Oman, France, and Sri Lanka. More than 60% of those interviewed reported seeing foreign vessels in their waters more than once per day.

q exactEarth, Cambridge, Ontario, Canada. Data obtained March 26, 2015.

r Available from www.seaaroundus.org.

s Sea Around Us reconstruction stopped in 2010. Therefore, to estimate Somali catch from 2011–2013, we carried forward the estimate of catch in 2010.

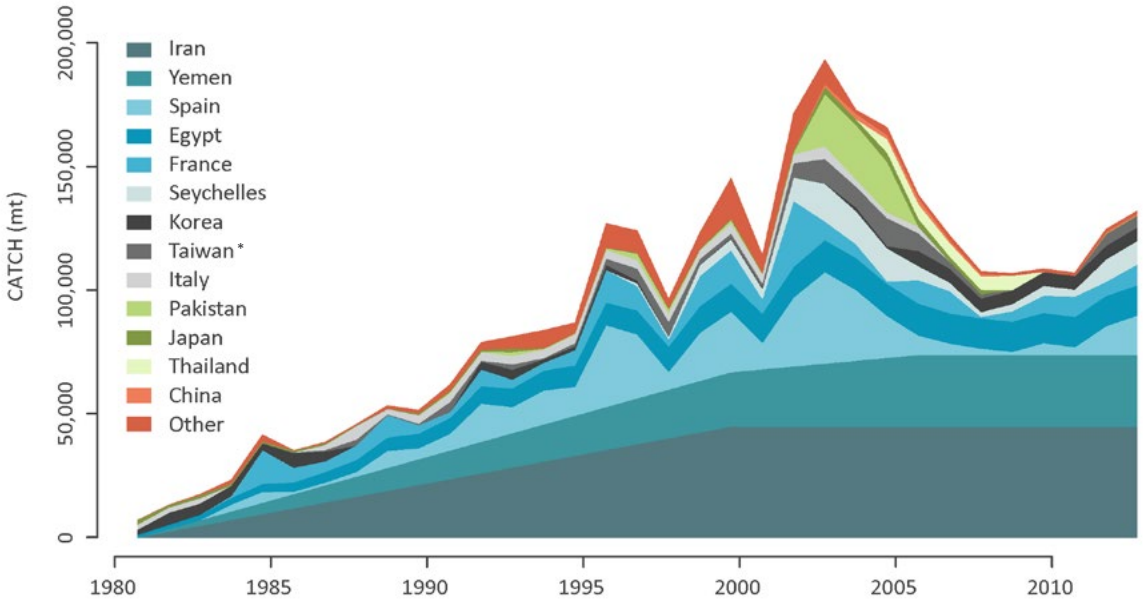
TABLE 2.2 Summary of foreign catch (in metric tons) in Somali waters, 1981–2013. The decadal columns give the average catch in one year for that decade (not the total catch over ten years).

Fishing Nation	1980s	1990s	2000s	2010s	Total 1981-2013	Estimation Method
Iran	9,444	31,874	44,853	44,853	1,031,673	Reconstruction
Yemen	4,635	15,644	26,537	28,970	579,404	Reconstruction
Spain	1,995	14,803	16,178	8,884	363,296	IOTC
Egypt	3,240	8,370	12,420	12,240	286,020	Reconstruction
France	4,369	6,345	8,335	7,352	215,529	IOTC
Seychelles	13	650	7,407	6,315	105,948	IOTC
Other	694	4,912	4,440	0	99,756	IOTC
Korea	3,172	1,361	2,654	5,495	90,680	IOTC
Taiwan*	387	2,481	5,066	2,360	88,393	IOTC
Italy	1,758	3,440	2,408	0	74,306	Reconstruction
Pakistan	0	792	6,595	0	73,878	Allocation
Japan	840	507	1,809	158	31,348	IOTC
Thailand	0	0	2,818	9	28,215	Reconstruction, IOTC
China	0	0	922	239	10,174	IOTC
Ex-Soviet	6	148	653	0	8,067	IOTC
Kenya	0	0	4,800	3,200	8,000	Reconstruction
Greece	447	0	0	447	2,235	Reconstruction
Portugal	0	0	208	0	2,080	IOTC
Mauritius	0	138	1	0	1,390	IOTC
Rèunion	0	35	0	0	348	IOTC
Total	30,999	91,500	144,104	118,123	3,100,741	

**Province of China*

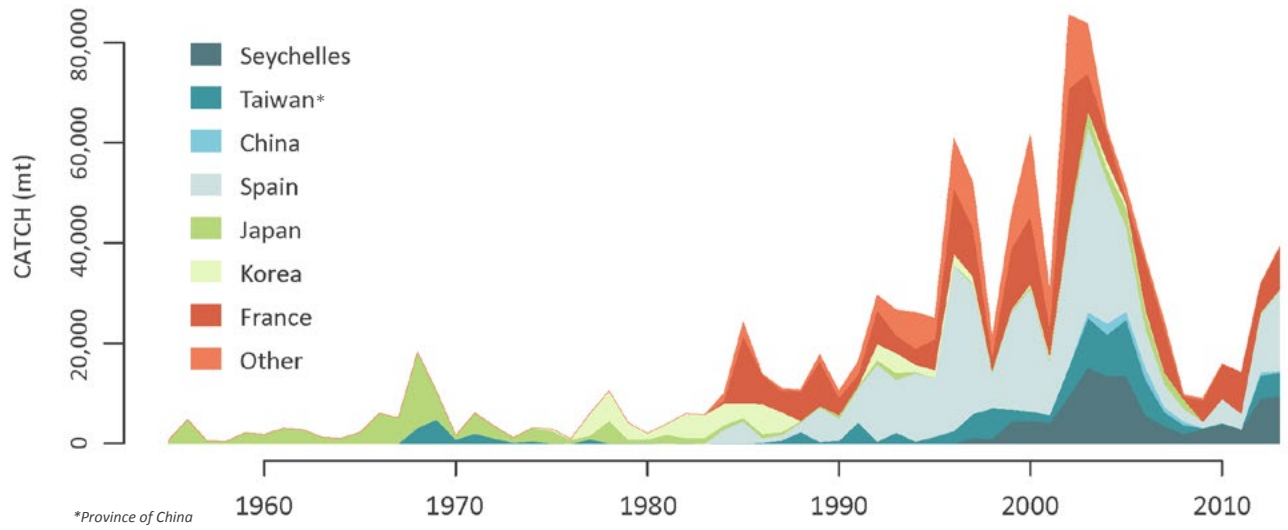
Catch by IOTC vessels in Somali waters

Purse seine and longline vessels catch significant amounts of tuna and tuna-like species as they migrate through Somali waters (Figure 2.5). The peak IOTC catch in 2003 (about 95,000 mt) was likely driven by an unusually good fishing year for HMS in the Somali basin.[48] The decline in catch around 2005 was driven by several factors: the expiration of private agreements with EU purse seine vessels[49] that allowed access to Somali waters, the southward movement of the purse seine and longline fleets to follow record numbers of tuna in Kenyan and Tanzanian waters, and a peak in pirate activity[50] that caused vessels to avoid Somali waters (Figure 2.6). In 2013, we estimate IOTC nations caught just under 50,000 mt of HMS, approximately equivalent to the catch of all species by the Somali domestic fleet (see Chapter 3). Spain and the Seychelles top the list of nations whose flagged vessels catch fish assigned by our approach to Somali waters; in the case of the Seychelles, many of these vessels are owned and operated by Taiwan (Province of China). France, South Korea, and Taiwan round out the top five foreign fleets that likely had a presence in Somali waters in 2013 (Figure 2.7).



**Province of China*

FIGURE 2.5 Estimated catch of HMS by IOTC member nations in Somali waters.



We must stress the uncertainty inherent in our approach to estimating the location of fishing by IOTC Member nations and Non-Contracting Cooperating Parties. Purse seine catch is reported in 1°×1° cells, and longline catch is reported in 5°×5° cells. Our disaggregation approach (assigning cells that overlap the boundaries of the Somali EEZ) makes the assumption that catch is uniformly distributed in these cells. Our assignment of catch to Somali waters is the best estimate made with the available data. The spatial patterns of catch by countries estimated to be fishing in Somali waters since 2006 (Spain, France, Taiwan (Province of China), Seychelles)

FIGURE 2.6 Spatial distribution of IOTC-based fishing fleet in the Western Indian Ocean over time.

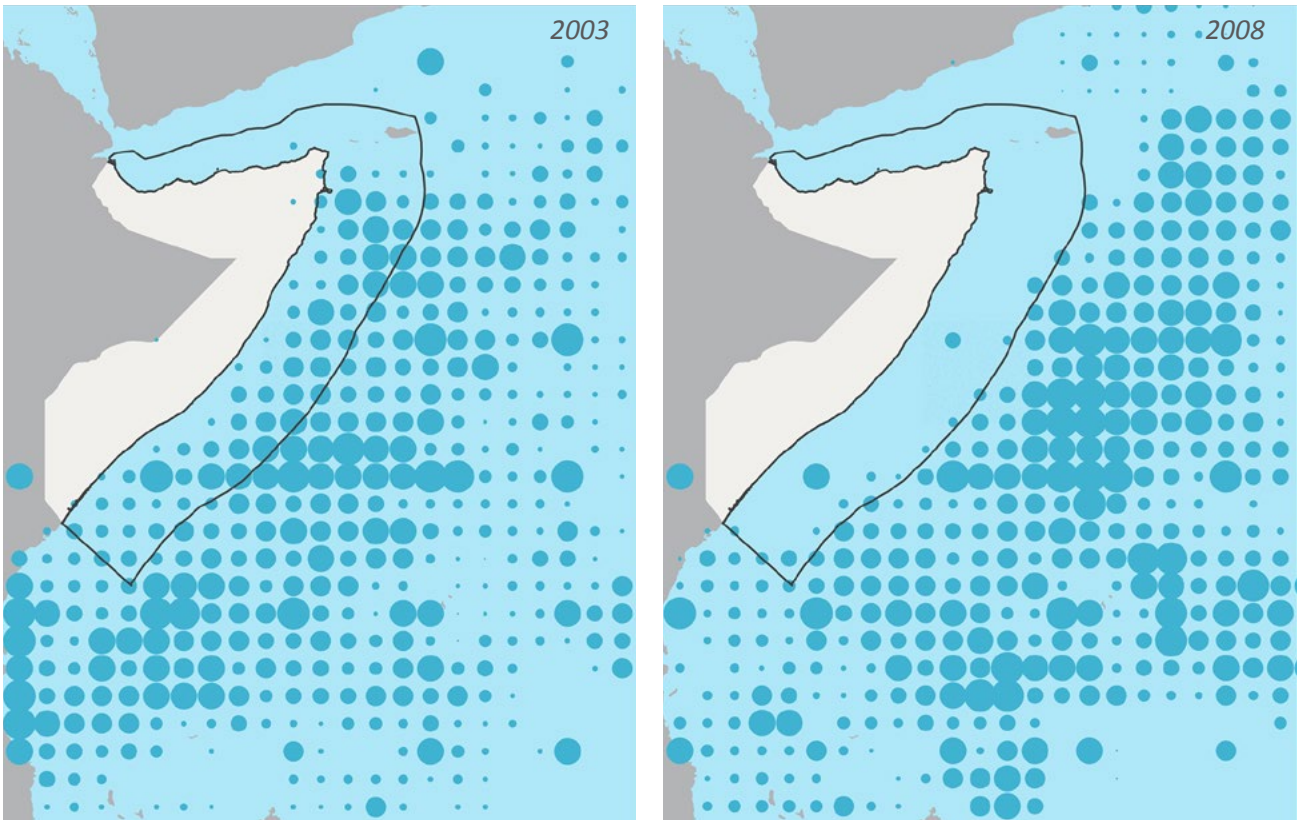
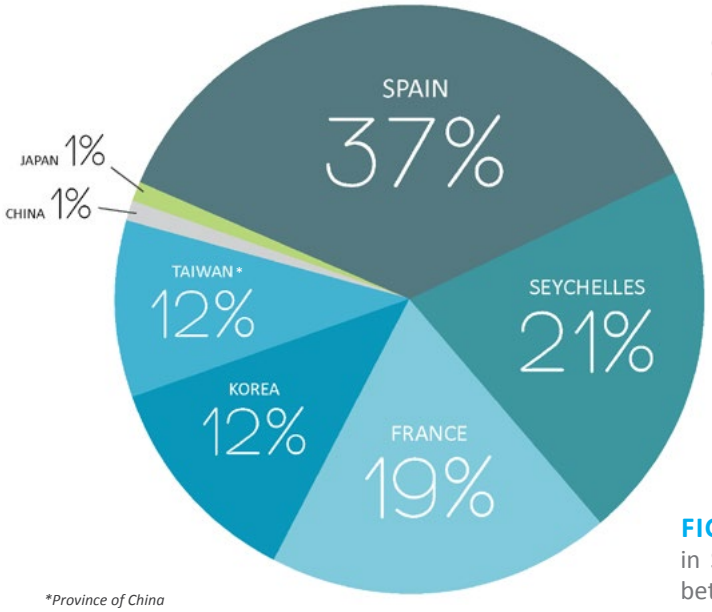


FIGURE 2.7 Proportion of catch assigned to IOTC nations fishing in Somali waters during 2013.



*Province of China

show these countries "fishing the line" of the Somali EEZ. While our approach assigns this catch to Somali waters, the fishing vessels may have been just outside the boundaries. More accurate reports of catch location would significantly aid in estimation, and we welcome new sources of information from the relevant nations. For a better understanding of the spatial extent and temporal patterns of catch reported to the IOTC, please see the animations made available on our website.[t]

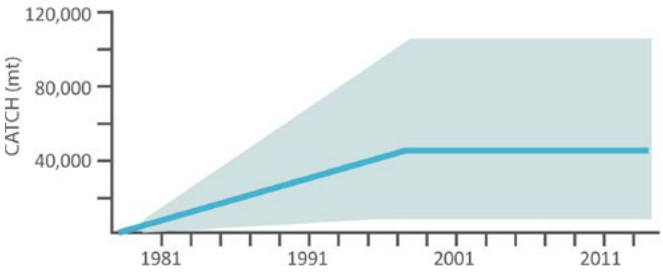
Estimates of catch on a country-by-country basis

In the following pages, we report estimates of catch by each country that we believe fishes (or has fished) in Somali waters; countries are listed in order by the accumulated volume of fish caught between 1981 and 2013.

Iran

We estimate Iran caught 45,000 mt of fish in Somali waters in 2013 and has caught 1,032,000 mt since 1981 (Figure 2.8). Iran has a large fishing fleet: in 2007, its gillnet fleet had 6,363 boats[51] (1,296 of which are authorized by the IOTC to fish outside Iranian waters). In 2013, the UN Security Council reported 180 Iranian gillnet vessels were fishing in Somali waters.[52] Our reconstruction was based on a range of 5 vessels minimum[53] and 180 vessels maximum.[54] The vast majority of Iranian vessels in Somali waters are targeting tuna. Quantitative catch composition was not available, but a significant amount of catch is known to be yellowfin and skipjack tuna.[55] Bycatch likely includes billfishes, sharks, rays, and mammals.[56] To estimate the amount of catch made by these vessels, we applied global estimates of fish storage capacity on coastal gillnet vessels.[57] Vessel data were available spanning 2000–2013, and we extrapolated from 2000 to zero catch in 1981. Given the large ranges of possible numbers of boats and their catch capacities, the 95% confidence intervals (CI) are very large (9,000 mt–104,000 mt for the years 2000–2013). Iranian vessels have been accused of fishing illegally in Somali waters by the Somali delegation to the IOTC, who recently provided photographic evidence of their charge.[58]

FIGURE 2.8 Reconstruction of catch by Iranian vessels in Somali waters. Solid line is the mean; shaded area is between 5% and 95% CI.



Yemen

Yemen and Somalia have a complicated fishing history that is simultaneously mutually beneficial and conflictual (Box 2.3). Our research suggests Yemeni fishing boats began operating in Somali waters in notable numbers in the early 1980s, especially in Somaliland.[59] At that time there was little reason for conflict between Yemeni and Somali fishers, although Mohamed Yassin,[60] anticipating future conflict, advised a coordinated management plan for the Indian oil sardine because these fish regularly traverse the Somali-Yemeni border in the Gulf of Aden. In the early 1990s, Yemeni vessels purchased fish directly from Puntland-based Somali fishers in the Gulf of Aden. The price received was favorable to Yemeni purchasers[61] and still represents a large market for Somali fishers.

t http://securefisheries.org/report/securing-somali-fisheries

Box 2.3: The Complicated Relationship with Yemen*

Berbera fisherman, Jean-Pierre Larroque

In April 2015, Houthi rebels forced Yemen's President Abdu Rabbu Mansour Hadi to flee, and hundreds of Yemeni civilians died in the ensuing conflict. Saudi Arabia intervened soon thereafter with a bombing campaign and a blockade of Yemen's port cities to cut off Iranian resupply of rebels. Besides blocking weapons, the blockade also had a major impact on food security and food assistance in Yemen, and its effects spilled over into Somalia.

The UN Food and Agriculture Organization estimates that 10.6 million Yemenis are currently food insecure and nearly 5 million are facing emergency conditions characterized by malnutrition and lack of food access.[63] The rapid escalation of fighting increased domestic food prices, disrupted food markets, and interrupted access to marine fisheries.

Yemen's marine fish catch has increased tenfold since the 1970s. To sustain this increase, fishers have expanded their reach into Somali waters. In 1994, an agreement was reached with local authorities in Heis whereby Yemenis would deliver fuel in exchange for rights to fish in Somali waters. Such arrangements continue today, but in a slightly different form: Yemenis bring ice as well as fuel (which is subsidized in Yemen, but difficult to come by in Somalia) and in exchange purchase fish directly from Somali fishers at favorable prices.

But as stocks in Yemeni waters have declined due to heavy fishing, more and more boats have crossed into Somali waters without licenses. Estimates suggest that before the blockade between 200[64] and 300[65] Yemeni boats were fishing illegally in Somali waters at any given time.

Mahad Awale, a field manager in Puntland for the non-profit Shuraako, says the number of Yemeni fishers coming to Somali waters dropped to almost zero when the blockade began. According to the State Minister for Fisheries and Marine Resources in Puntland, Abdi-R Kulmiye, Yemenis that came to trade fuel for fish usually made three trips a month, carrying home between 10 and 18 metric tons of fish per trip.[66] For those Yemenis living in coastal cities where fish protein is important, the cessation of these trips will exacerbate already critical food shortages.

The interruption of this trade has also impacted Somalis. Without a Yemeni market, Somali fishers have taken their catch from Bosaso to the major port city of Berbera, almost 900 kilometers away by road. On average, the prices obtained in Berbera are lower than those received from Yemeni boats, and our sources suggest the ability of the Berbera market to absorb excess fish is likely short-lived. Furthermore, without access to ice brought from Yemen, Somali fishers risk spoilage of current inventory. One Puntland-based fishing company reported a 50% decline in profits since the outbreak of conflict, largely driven by a decline in fish prices. The short-term effects, therefore, are likely to be negative for Somali fish traders.

* Modified from http://www.newsecuritybeat.org/2015/04/blockade-yemeni-ports-unintended-consequences-food-security-somali-fishing-industry/

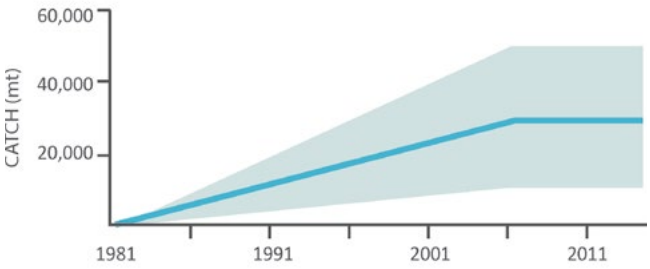
Box 2.3, continued

On the other hand, long-term impacts may be a boon. For almost 18 years, Yemen has dominated the fish market in Somalia and a significant amount of that catch is re-exported to Djibouti, Oman, and Dubai. Awale notes that Somali fishers have expressed optimism that the current shock to their markets may have a diversifying effect by removing Yemen as a price-setter and intermediary. Somali fishers stand to earn higher profits if they can sell directly to other regional markets. Finally, the absence of Yemeni fishing boats during the conflict may improve Somali fish catch.

In an interesting twist, piracy justified Iranian military engagement near Yemen. In late March 2015, Somali pirates took hostage two Iranian fishing vessels that were in Somali waters without license. In response, Iran deployed two warships to the Gulf of Aden, which in turn provoked additional naval deployment from the United States[67] and Saudi Arabia.[68] While the Iranian navy maintained that deployment of these warships was to protect its fishing fleet from pirates, their presence near Yemen may also have provided support to the Houthi rebels.

The most immediate impact of violence in Yemen was on the civilian population, as the Saudi-led bombing campaign claimed civilian lives, destroyed infrastructure, and disrupted markets. But indirect and long-term impacts on fishing communities, in both Yemen and Somalia, could be substantial as well.

FIGURE 2.9 Reconstruction of catch by Yemeni vessels in Somali waters. Solid line is the mean; shaded area is between 5% and 95% CI.

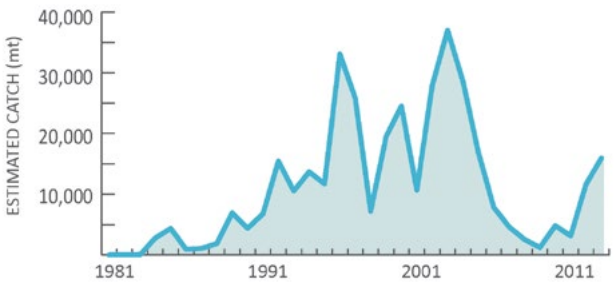


We estimate that Yemen currently catches 29,000 mt of fish in Somali waters each year, catching 579,000 mt since 1981 (Figure 2.9 and further details in Box 2.3). Yemeni reports to the IOTC[u] indicate catch composition of yellowfin (48%), other tunas including longtail, narrow-barred Spanish mackerel (or kingfish), frigate tuna and kawakawa (38%), and sharks (5%). However, others[62] report very high landings of sharks to support a profitable shark fin export industry.

Spain

We estimate that Spanish vessels caught approximately 16,000 mt of fish in Somali waters in 2013 and have caught 363,000 mt since 1981 (Figure 2.10). Estimated annual catch ranged from 933 mt (1987) to 36,983 mt (2003) and consisted of skipjack tuna (56%), yellowfin tuna (35%), and bigeye tuna (8%). The vast majority of catch (99%) was from purse seine vessels, with the balance from longline vessels.

FIGURE 2.10 Estimated catch by Spanish-flagged vessels in Somali waters.



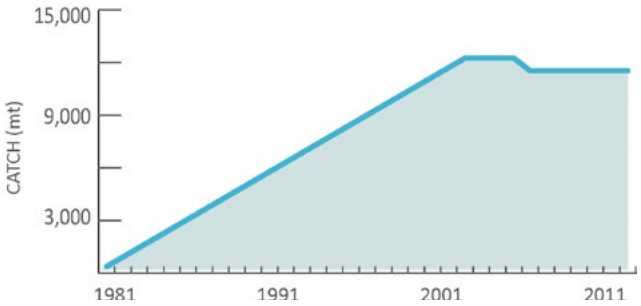
Egypt

Egyptian trawlers have operated in the waters of Somaliland since the early 1980s, filling a vacuum left by the dissolution of the Soviet joint venture SOMALFISH.[69] At that time, no more than 10 trawlers from Egypt and Italy combined were operating in Somali waters. By 2003, 36 Egyptian trawlers were operating and in 2007, 34 were reported. Published estimates[70,71] of catch by these vessels agree[v] on a value of 30 mt per trawler-month; of that, 5%

u While Yemen reported catch to the IOTC for 2003–2007, the reports were not spatially explicit (and they were unrealistically high) so we did not include them in the IOTC analysis.

v It is unclear whether the two references for catch refer to the same raw values, refer to each other, or arrived at these estimates independently.

FIGURE 2.11 Estimated catch by Egyptian-flagged vessels in Somali waters.



of catch was shrimp and the remainder was finfish. We estimate Egyptian trawlers caught approximately 13,000 mt per year when 36 trawlers were operating and that catch totals 286,000 mt since 1981 (Figure 2.11). Unlike our reconstructions for Iran and Yemen, we do not have enough data to estimate confidence intervals.

While trawlers have been licensed through Somaliland since at least the early and mid-2000s, there has been a recent shift in policy and public opinion against Egyptian trawlers. Somaliland ceased licensing foreign fishing vessels in 2012.[72] Reports[73] that are difficult to verify indicate two trawlers were arrested and held in Las Koreh in 2009, and one trawler was arrested in Somaliland in 2014.[74]

France

We estimate French vessels caught approximately 6,000–8,000 mt of fish in Somali waters per year in 2013 and have caught 216,000 mt since 1981 (Figure 2.12). Their catch consisted of skipjack tuna (53%), yellowfin tuna (38%), and bigeye tuna (9%). Vessels are exclusively purse seiners. Annual catch has ranged from 610 mt (1984) to 26,634 mt (2002).

Seychelles

We estimate Seychellois vessels caught approximately 9,000 mt of fish in Somali waters in 2013 and have caught 106,000 mt since 1981 (Figure 2.13). Annual catch ranged from 1 mt (1996) to 15,257 mt (2003), primarily by longline vessels, although purse seiners and coastal vessels employing handlines were also reported. Catch composition included skipjack (51%), yellowfin tuna (33%), and bigeye tuna (12%). Other tuna, swordfish, other billfishes, and several species of shark comprised the remaining 4%.

FIGURE 2.12 Estimated catch by French-flagged vessels in Somali waters.

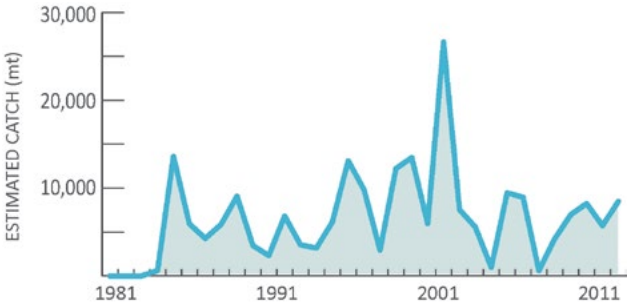
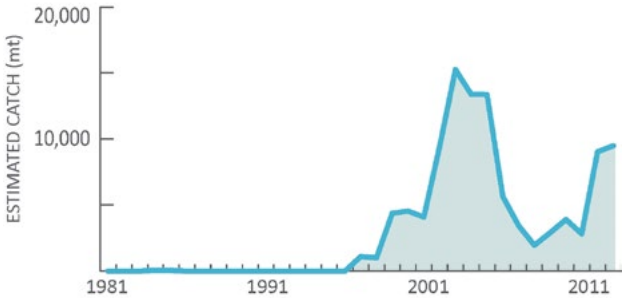


FIGURE 2.13 Estimated catch by Seychelles-flagged vessels in Somali waters.



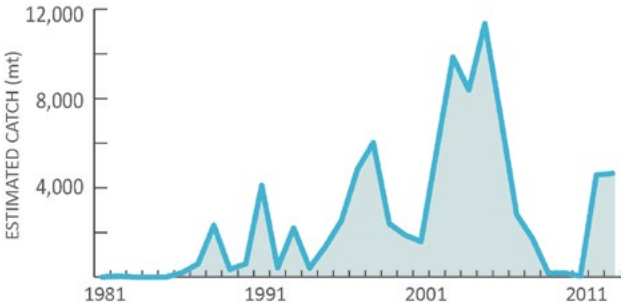
Taiwan (Province of China)

We estimate Taiwanese vessels caught approximately 5,000 mt of fish per year in Somali waters in 2013, and have caught 88,000 mt since 1981 (Figure 2.14). Annual catch has ranged from 38 mt (1982) to 11,358 mt (2005). Catch consists of bigeye tuna (45%), yellowfin tuna (29%), swordfish (14%), and blue and striped marlin (6%). All catch is from longline vessels, except two data points in 1987 and 1991 that are gillnet vessels. Taiwan is also likely flagging its vessels to other countries (like the Seychelles).

Italy

Italy has a long history of involvement in Somali fisheries. In the 1930s, Italians built two tuna canneries on the north shore of Somalia to process catch by their fleet.[75] Fishing for tuna off northern Somalia continued through at least the 1950s. Trawling began in the late 1970s and continued, under various auspices, until 2006. Three Italian trawlers owned by an Italian seafood company, *Amoroso e Figli,* operated during 1978–1979. In 1981,

FIGURE 2.14 Estimated catch by Taiwanese*-flagged vessels in Somali waters.

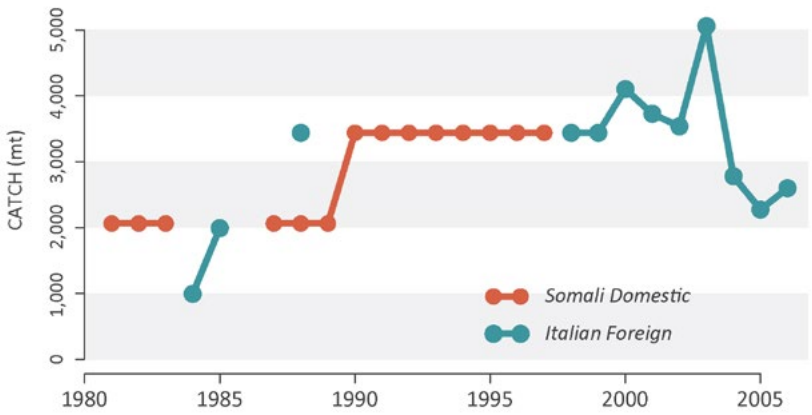


*Province of China

a joint venture between Italy and Somalia, SOMITFISH, began operations that continued through 1983. After a lull in trawling, SOMITFISH was reconstituted as SHIFCO, and between three and five trawlers operated until 2006. Finally, in addition to the SHIFCO trawlers, one trawling vessel operated in (at least) 1984,[76] two in 1985,[77] and five in 1988,[78] but very little information about these trawlers is available.

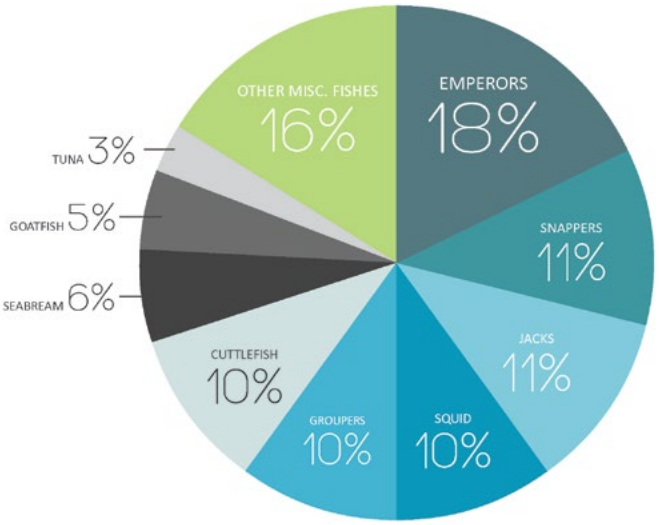
Our reconstruction of Italian fishing in Somali waters is based on data available for the SHIFCO trawlers. An Italian seafood importer, *PanaPesca SpA*, built and then gifted trawlers to the Somali government for operation. In return, the catch of these vessels was sold exclusively to *PanaPesca*. Three trawlers were built and operated beginning in 1981, and two more were added to the fleet in 1990. Each trawler was 57–66 m in length and held 40 crew members.[79] These vessels reflagged from Somalia to Belize in 1997 or 1998 (see Appendix 2). For the purposes of our reconstruction, catch from vessels flagged to Somalia are included in domestic numbers, therefore catch assigned to Italy from these trawlers covers the period 1998–2006. Catch from SHIFCO vessels was applied to known trawling activity during 1981–1997. Today there is no fishing by Italian-flagged vessels in Somali waters.

FIGURE 2.15 Reconstructed catch by Italian trawlers.



Domestic catch (orange) was assigned to Somalia. Foreign catch (blue) was assigned to Italy. Assignments were based on flags of trawlers (Somalia versus non-Somalia).

FIGURE 2.16 Catch composition by Italian trawlers.



Between 1981 and 2006, Italian trawlers landed between 2,000 and 5,000 mt of fishery resources annually, for a total of 74,000 mt since 1981 (Figure 2.15). The vast majority of catch was coastal, often reef-associated species of fish; cephalopods were also a significant component (Figure 2.16). In 2006, the vessels stopped operating in Somali waters due to high fuel costs and conflict between vessel owners and authorities in Aden, and SHIFCO's involvement ceased.[w] At that point, most had reflagged to a variety of countries. The area trawled by the former Italian fleet, and the market they supplied, was replaced by the South Korean trawlers discussed below.

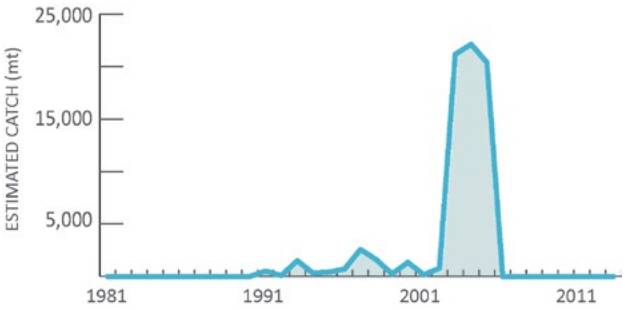
Pakistan

Little information is available to inform reconstructions of fishing by Pakistan. Our interviews with experts[80] suggest that their fishing presence in Somali waters is likely. Estimates from catch allocation are 74,000 mt during 1991–2005, or 5,000 mt

w Additionally, in 2006 the vessels violated their exclusivity agreement with SHIFCO and sold catch to another Italian company.

per year, exclusively from gillnets (Figure 2.17). A high ratio of sharks to non-sharks in the gillnet fleet suggests targeting.[81] Spanish mackerel also is a significant component of catch by Pakistani vessels.[82]

FIGURE 2.17 Estimated catch by Pakistani-flagged vessels in Somali waters.

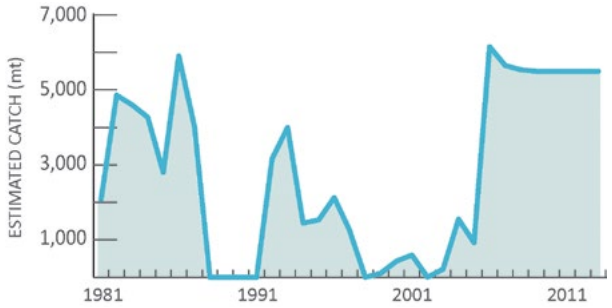


South Korea

South Korean fishing in Somali waters consists of two general fleets: longline vessels targeting HMS covered by the IOTC, and trawlers targeting demersal fishes and cephalopods. To estimate catch by South Korean vessels, we combined analysis of IOTC catch data with analysis of AIS satellite data. We estimate South Korea has caught 47,000 mt of HMS inside Somali waters since 1981. Their catch consists of yellowfin tuna (45%), bigeye tuna (39%), swordfish (5%), and blue and striped marlin (5%). The IOTC-registered vessels are almost exclusively longline, with a small tonnage of catch by purse seiners in 2012 and 2013. Annual catch of HMS has ranged from 2 mt (2009) to 5,971 mt (1978).

To estimate catch by the South Korean trawl fleet, we used AIS to calculate days trawled per year for seven known trawl vessels operating in Somali waters in 2010–2014 (for more details, see §4 below and Appendix 3). We combined these data with six months of catch data to determine mean catch per boat per day. We calculated that the South Korean trawl fleet caught 27,000 mt during this period. On average, this equates to 5,495 mt per year from trawling. We applied this value to the years in which South Korean trawling has occurred (beginning in 2006). Catch consisted largely of cephalopods, with cuttlefish comprising 20% of catch and squid comprising 19%. The main fish catch was emperors (17%), followed by barracudas (9%), and grunts (7%). Our estimate of 5,495 mt annually may be an underestimate as there may have been vessels trawling in Somali waters that were not broadcasting AIS. A regional expert estimated

FIGURE 2.18 Estimated catch by South Korean-flagged vessels in Somali waters.



that catch by these trawlers that was landed in Salalah, Oman, was greater than 6,000 mt in 2014.[83] Figure 2.18 combines longline and trawl catch by South Korean vessels.

Japan

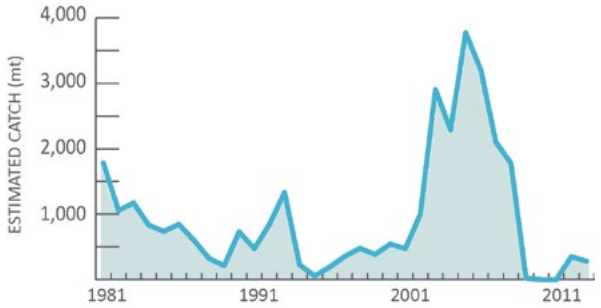
We estimate Japanese vessels caught approximately 300 mt of fish in Somali waters in 2013 and have caught 31,000 mt since 1981 (Figure 2.19). However, Japan has reported data to the IOTC since 1955, the earliest records available, and some of this early catch appears to have occurred in Somali waters as well. Japanese vessels were absent in the Somali EEZ during 2010 and 2011, but returned during 2012 and 2013. Their catch consists of yellowfin tuna (50%), bigeye tuna (25%), striped marlin (10%), and small volumes of other tunas and billfishes. Vessels are predominantly longline vessels, with some catch by purse seiners during the early 1990s. Annual catch has ranged from 21 mt (2009) to 3,772 mt (2005).

Thailand

We estimate Thai vessels have caught 28,000 mt since 1981 (Figure 2.20). Thailand did not report spatially disaggregated data to the IOTC until 2006; at that point, its purse seine fleet was widely distributed across the Indian Ocean.[x] Spatially disaggregated catch was not reported in 2007, 2008, or 2010, but we assumed the distribution of purse seine vessels was similar to 2006, 2009, and 2011–2013. We estimate between 35 and 490 mt of HMS were caught by Thai purse seine vessels during this time. Catch was 74% skipjack, 16% bigeye, 10% yellowfin, and 1% swordfish.

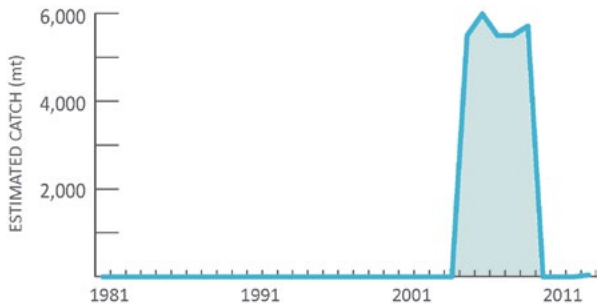
x http://securefisheries.org/report/securing-somali-fisheries

FIGURE 2.19 Estimated catch by Japanese-flagged vessels in Somali waters.



Thai trawlers also operated in Puntland from at least 2005 to 2009. A document[84] produced by the Puntland Coast Guard reports an incident in which three Puntland-based officers guarded a Thai trawler. The official notes a private agreement between the State of Puntland and the Thai seafood company Sirichai. Seven trawlers, owned by Sirichai, operated year-round in Puntland. These vessels were licensed, operated for six consecutive months by transshipping to a Thai freezer ship in Somali waters, and returned twice a year to Salalah (Oman) for repairs and unloading.[85] We were unable to find estimates for the amount of catch by each vessel; consequently, given the location of trawling and type of vessel, we reconstructed catch by these seven trawlers by applying the vessel catch-rate calculated for the Korean trawlers discussed above (785 mt per vessel per year). We believe this is a minimum estimate and likely underestimates the catch by these trawlers. Thai vessels withdrew from Somali waters in 2009 after a pirate attack in November 2008 on the trawler *Ekawatnava 5*: the Indian navy, thinking they were targeting a pirate mothership, sank the vessel, killing 14 Thai crew members along with the pirates.[86] Another Thai trawler, *Thai Union 3*, was hijacked in October 2009 and released in March 2010.

FIGURE 2.20 Estimated catch by Thai-flagged vessels in Somali waters.



China

We estimate Chinese vessels caught approximately 500 mt of fish in Somali waters in 2013, and have caught 10,000 mt since 1981 (Figure 2.21). Their catch consists of bigeye tuna (59%), yellowfin tuna (27%), swordfish (7%), and small volumes of other tuna, billfishes, and blue sharks. Vessels are exclusively longliners. Annual catch has ranged from 3 mt (2000) to 2,361 mt (2006).

FIGURE 2.21 Estimated catch by Chinese-flagged vessels in Somali waters.

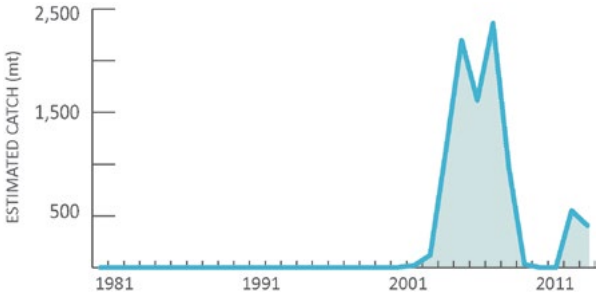
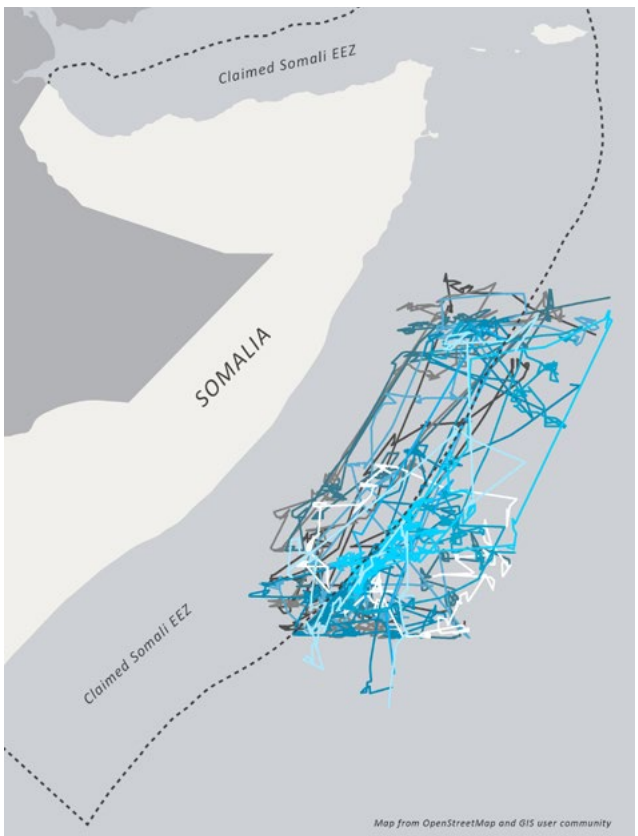


FIGURE 2.22 Automatic Identification System tracks of eleven Chinese longline vessels fishing during March-May 2015.

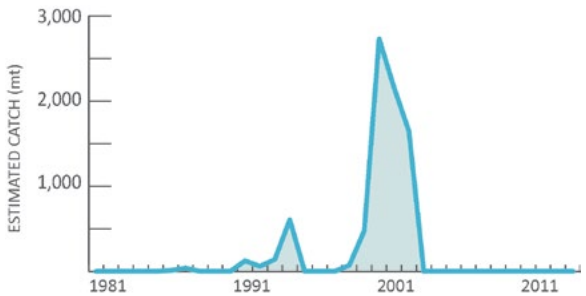


However, we suspect Chinese catch in Somali waters is much higher than that reported to the IOTC. Reports indicate Siad Barre sold fishing access rights to China in exchange for weapons. This exchange was formalized in a 1989 agreement, but this fishing likely continued well after the collapse of his regime in 1991.[87] No records exist to quantify this fishing, however. China's distant water fleet has a large footprint around the world, and it harvests approximately 3.1 million mt per year in African waters.[88] This catch is largely underreported, and it seems likely that this underreporting applies to Somali waters. In March 2015, the Somali delegation to the nineteenth session of the IOTC presented AIS evidence[89] that China had unlicensed longline vessels in Somali waters. The Chinese delegation responded and their vessels withdrew immediately, but they have since returned (Figure 2.22).

The Former Soviet Union

We estimate Soviet Union (or member) vessels have caught 8,000 mt since 1981 (Figure 2.23). Annual catch by purse seiners ranged from 12 mt (1986) to 2,730 mt (2000) and consisted of skipjack (69%), yellowfin (23%), and bigeye tuna (6%). Soviet trawlers were also important joint ventures with Somalia, likely targeting bottom fishes and lobster (see Chapter 1, §4.3).

FIGURE 2.23 Estimated catch by Soviet-flagged vessels in Somali waters.



Portugal

We estimate Portuguese vessels have not recently caught fish in Somali waters but have caught approximately 2,000 mt since 1981 (Figure 2.23). In 2005, Portuguese longliners caught 2,043 mt of fish, primarily blue shark (64%), swordfish (27%), and mackerel sharks (4%). Catch in 2006 (34 mt) and 2007 (3 mt) also were estimated.

Greece

We estimate Greek trawlers have caught 2,235 mt of fish in Somali waters since 1981. Greek trawlers began operating in Somalia during the 1960s. Haakonsen[90] reported "a few" licensed Greek trawlers operating in the mid-1960s and Bihi[91] noted "a number of" Greek trawlers operating in at least 1983. After 1983 and until recent times, we found no reports of Greek vessels in Somali waters. Two Greek trawlers flagged to Belize, the *Greko 1* and *2*, have been operating since 2010. These vessels appear to be licensed and have been fishing off the southern Somali coast. The composition of catch is unknown. To estimate catch by these trawlers, we assumed catch rates per gross tonnage were similar to the Korean-flagged trawlers operating in recent years. That is, we applied the same catch per gross ton from the Korean trawlers (1.16 mt per GT) to the Greek trawlers (each 193 GT),[92] for a total of 447 mt per year. We assumed two trawlers were present in 1983, and two were present from 2010 – 2013.

Kenya

Kenyan prawn trawlers have operated along the southern Somali border, near the Juba River, since at least 2004.[93] There are reports of 19 illegal trawlers catching 800 mt of prawns each year, for a total of 8,000 tons since 2004.[94] The border between Somalia and Kenya contains sensitive nesting grounds for sea turtles, and the prawn fishery has been accused of killing turtles as bycatch in trawl nets.[95] Recently, the Kenyan government banned fishers from crossing into Somali waters because of security concerns around Al Shabaab. This has resulted in a significant loss of income for Kenyan fishers in the region.

Mauritius

Mauritian fishing in Somali waters has been extremely limited. During 1989–1999, we estimate their purse seiners caught 1,400 mt, between 20 and 500 mt of fish annually. Catch was primarily skipjack (83%) and yellowfin tuna (13%). We estimate 7 mt were caught in Somali waters by a longline vessel in 2008, but this is likely an artifact of the methodology by which longline data were assigned to the Somali EEZ.

La Réunion (France)

We estimate La Réunion, a French departement, has caught 350 mt of fish in Somali waters since 1981. Catch from longliners ranged from 2 to 158 mt per year and comprised swordfish (88%), yellowfin tuna (6%), and other tunas and billfishes. Like Mauritius, this could be an artifact of the method used to assign longline catch to Somali waters.

Other IOTC Vessels

The IOTC reports catch from vessels that are not assigned to a specific fishing nation. We estimate between 20 mt and 14,000 mt has been caught in Somali waters each year between 1984 and 2009. This catch consisted of skipjack tuna (58%), yellowfin tuna (34%), and bigeye tuna (8%). We include these estimates, a total of 100,000 mt over the time period, in our summary figures.

Nations for which more information is required

Sri Lanka

There are infrequent reports of fishing by Sri Lankan vessels in Somali waters. In the late 1990s, three Sri Lankan longliners were fishing for sharks out of Berbera and trawlers were also operating in Somali waters.[96] Catch composition and volume are not known. More recently, indirect evidence suggests fishing vessels from Sri Lanka may occasionally operate in Somali waters. In October 2011, the *Nimesha Duwa* was captured by pirates while fishing illegally in Somali waters.[97] In November 2010 and January 2011, two Sri Lankan fishing vessels (the *Lakmali* and *Darshana 6*) were hijacked by Somali pirates.[98] Both vessels were reportedly in international waters; some of the crew from the *Lakmali* escaped from the hijacked vessel to the island of Minicoy off the coast of southern India, lending support to the claim that at least this boat was fishing in international waters. It is unclear whether the other vessel was operating within 200 nautical miles of the Somali coast. In our interviews with Somali fishers (see Appendix 1), only one person (of 39 respondents) identified Sri Lanka as a country whose vessels they saw in their waters. Finally, Sri Lanka does report catch to the IOTC, and all of the reported catch we analyzed fell in the EEZs of either Sri Lanka or the Maldives. Consequently, while there is some evidence of Sri Lankan fishing in Somali waters, especially in prior decades, the scale of it may be small. However, there are reports of Sri Lankan vessels in Maldivian and Chagos waters,[99] indicating the possibility of their presence in Somali waters.

Silhouetted purse seine, Jon Anderson, Flickr

India

India claims almost 50% of all marine life caught in the Western Indian Ocean (2.2 million mt in 2013, Table 2.1), but there is little evidence of Indian fishing activity in Somali waters. The vast majority of the Indian fishing fleet is composed of small, coastal vessels that do not fish far from shore.[100] Forty-one drifting longline vessels are currently authorized to fish for tuna and tuna-like species outside the Indian EEZ;[101] however, none of the reported longline catch in the high seas falls within Somali waters. Further, most of India's catch is not HMS, which is what most commonly draws vessels to Somali waters. According to data reported to the FAO, India's catch in the Western Indian Ocean is Indian oil sardines (13%), croakers (9%), Bombay duck (8%), giant tiger prawns (6%), natantian shrimp (5%), hairtails (5%), cephalopods (3%), and anchovies (3%). Fish not identified comprise over 22% of all catch. These species are predominately confined to nearshore environments and are likely caught in Indian waters.

Experts[102] interviewed by Secure Fisheries agree that Indian vessels are likely not fishing in Somali waters. In our survey of Somali fishers (see Appendix 1), India was named frequently (by 12 of 39 respondents) as a country of origin for foreign fishers. However, our survey did not distinguish between the flag of a vessel and the national origin of its crew. Indian seafarers are commonly crew members on vessels flagged to other countries. Finally, there are no reports of Indian fishing vessels being

attacked by pirates. While circumstantial, there are records of pirate attacks against virtually all other nations who have a fishing presence in Somali waters; this suggests a small Indian fishing presence in the waters frequented by pirates. Consequently, at this time we do not assign any catch in Somali waters to Indian vessels. However, we urge the Government of India to require vessels fishing on the high seas and outside Indian EEZ boundaries to report more explicitly the location of their fishing activities and catch.

Oman and Djibouti

We have received anecdotal reports of fishing by vessels from Oman and Djibouti, but these have not been substantiated with numbers. Djibouti is negotiating their maritime boundaries with Somaliland[103] and Somalia, and there may be Djiboutian vessels fishing in this disputed area (see Chapter 1, Figure 1.2). When surveyed, fishers from Puntland and Somaliland reported seeing Omani vessels in their waters, but the reports were few.[y] Given the proximity to Somali waters and the similarity of Djiboutian and Omani fleets to other regional fishing fleets (e.g., Yemen), it is likely vessels from these two nations fish in Somali waters.

4. THE IMPACT OF TRAWLING IN SOMALI WATERS

Foreign trawlers have been operating in Somali waters since the mid-1970s. From then until the government collapsed in 1991, joint ventures were established with Italy, Egypt, Greece, Japan, France, the Soviet Union, Singapore, and Iraq. These agreements required licensing, landing the catch in Somalia, and catch reporting.[104] With the collapse of the government came the dissolution of most of these ventures and a loss of Somali oversight of trawlers.

A handful of trawlers operated through the ensuing political chaos (Chapter 1) and the surge in piracy. Five Italian vessels belonging to SHIFCO and 36 trawlers from Egypt operated along the northern coast (see §3). Due to high fuel costs,[105] the Italian effort ceased in 2006, and South Korean trawlers took over supplying the Italian market. Since then, those South Korean vessels have been targeting similar fishing grounds and species in Somali waters. Two Greek trawlers, the *Greko 1* and *2*, have been operating in southern Somali waters since 2010. Today, bottom trawling is illegal under the new Somali Fisheries Law (Article 33.1). Not only do some of these trawlers continue to operate, four of them are now flagged to Somalia and licensed in Puntland. Because of the lack of monitoring, control, and surveillance in Somalia, these trawlers have been free to operate at will, fishing without restrictions on time or location (i.e., unreported and unregulated). We do not know the full extent of the damage these vessels are doing to demersal fish stocks and benthic habitat as they drag nets along the bottom; here we make conservative estimates of the impact bottom trawling is having on Somali fisheries.

4.1 Trawling by Seven Korean Vessels

To better understand the impact of the South Korean trawling fleet, we analyzed Automatic Identification System data[z] broadcast in Somali waters during 2010–2014 for seven known bottom trawlers (ranging from 49–68 m long, 439–888 gross tonnage).[106] Active trawling was identified[107] based on the speed at which the vessels were traveling (speed over ground). Catch composition for two of the trawlers was combined with trawl location and duration information to estimate total catch and species composition. While the presence of seven vessels was confirmed by AIS, data needed to quantify trawling was only available for five of these vessels. For complete methodology, see Appendix 3.

It is important to note that the amount of trawling, area covered, and catch amounts are likely underestimates because of the limitations of AIS data. AIS is not mandatory for fishing vessels, nor is it a tamper-proof system, so vessel operators can turn it off at will or adjust the kind of information broadcast (Box 2.2). Crucial information was often missing from broadcasts we obtained, such as speed over ground. Some latitude/longitude coordinates were obviously incorrect, and large gaps in the data stream were created when the system was turned off. Finally, it is possible there were vessels trawling in Somali waters that were not broadcasting AIS at all.

y Out of 39 respondents, three indicated foreign vessels from Oman were present in their waters.

z exactEarth, Cambridge, Ontario, Canada. Data obtained March 26, 2015.

The amount of time these vessels spent in Somali waters is significant. On average, each vessel trawled for 229 days per year in Somali waters (Figure 2.24). This is comparable to the South Korean vessels' Italian counterparts that trawled for approximately 55 days during each of four trips per year.[108]

FIGURE 2.24 Days trawling per South Korean vessel per year.

During May through January, these vessels trawled 73% to 87% of days in any given month (Figure 2.25). Trawling was reduced during February through April, with trawling occurring during 34% to 62% of those months, likely due to challenging ocean conditions during that period.

Most trawling took place off the coast of Puntland, partly driven by an ocean bottom type favorable to trawling and high fish availability over the wide continental shelf, but also due to licenses provided by the state of Puntland. The vast majority of trawling (95%) was concentrated in shallow waters within the 75 m depth contour (Figure 2.26 and Appendix 3).

Each boat trawled approximately 3 km^2 per day. Over the time period for which we have data, this scales up to 120,652 km^2, an area slightly greater than the land mass of Somalia's near neighbor, Eritrea. This estimate, while large, does not account for the magnified impact of trawling over the same habitat again and again. Several areas in northeast Puntland are bearing the brunt of trawling by these vessels (Figure 2.27) and likely experience significant ecosystem damage as a result.

Volume of catch made during a fishing campaign was estimated from catch certificates that two of the vessels submitted to the European Union. We extrapolated catch from these certificates to the additional vessels and trawl periods for which we had AIS data (see Appendix 3 for detailed methods). As a result, we estimate that, on average, these trawlers caught 5,495 mt per year. Data on the composition of this catch was supplied by a European seafood importer. The catch varied widely depending on time of year (Figure A3.1) and, on average, was dominated by cephalopods with cuttlefish comprising 20% of catch and squid comprising 19%. The main fish catch was emperors (17%), followed by barracudas (9%), and grunts (7%) (Figure 2.28).

4.2 Potential Impacts of Trawling

Due to the limited ability to conduct scientific surveys in Somali waters, there have been no studies since the 1980s on benthic habitat type, nor on distribution and diversity of benthic invertebrates and demersal fishes.[109,110] Thus, the direct and indirect impacts of trawling in Somalia are purely speculative and are based on studies conducted around the world on the effects of

FIGURE 2.25 Proportion of days trawled in Somali waters by South Korean trawlers.

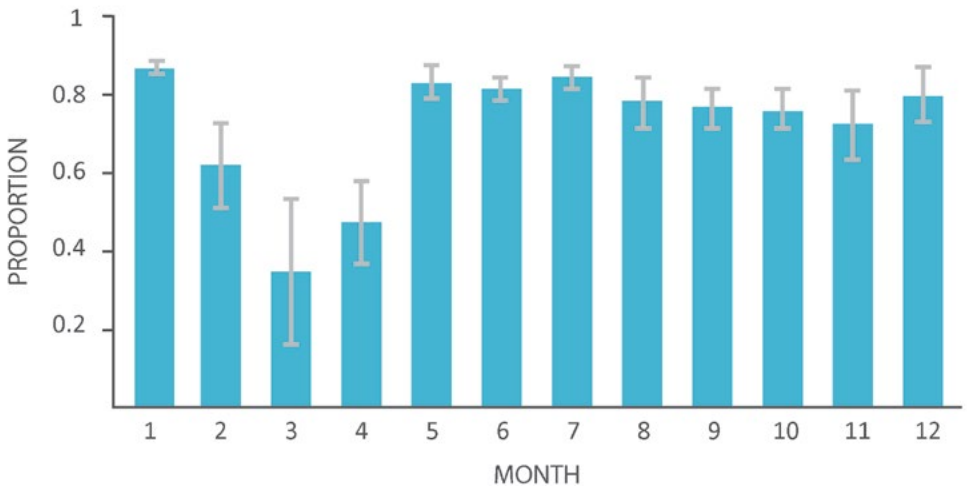
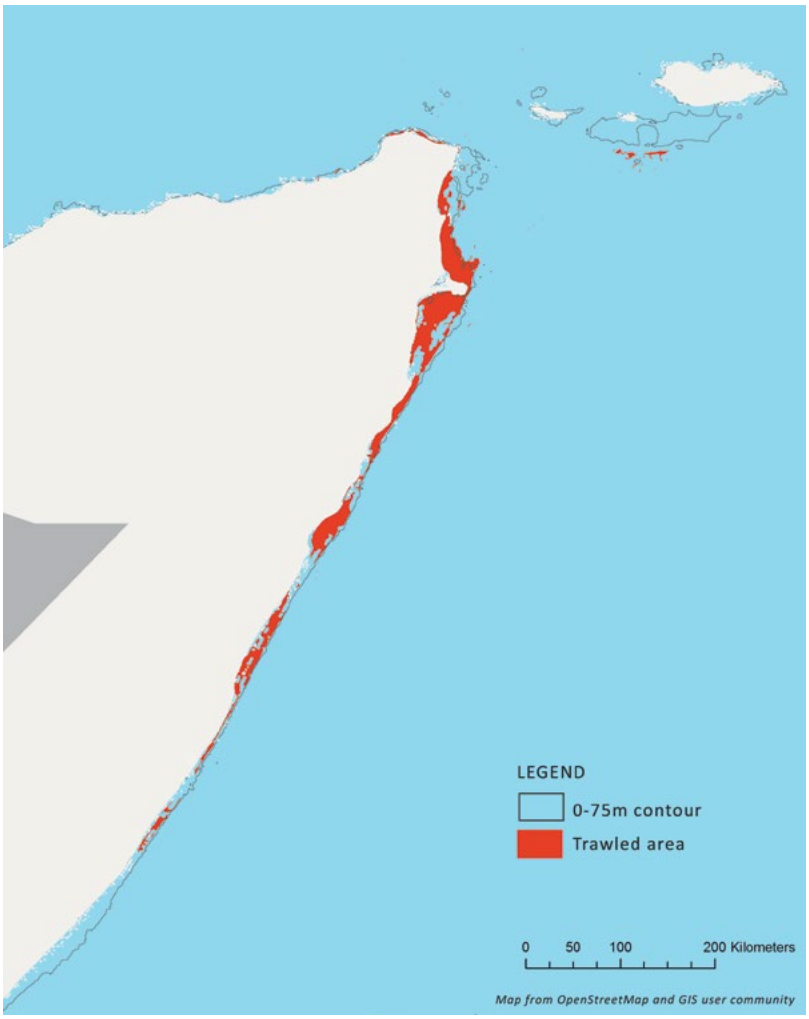


FIGURE 2.26 Total extent of area trawled by five South Korean vessels during 2010–2014.



trawling. Trawling results in significant levels of bycatch of non-target species, including at-risk species such as marine turtles and sharks. Unwanted bycatch is usually thrown overboard and mortality rates of those animals are very high.[111]

Moreover, trawling can change the structure of bottom sediments by: carving tracks from the doors onto the seafloor; re-suspending sediments, nutrients, and minerals into the water column; and smoothing and compacting sediments over time. Such changes disrupt the biogeochemical exchange systems between the bottom and the water column.[112] More alarming are the effects on the benthic community, such as corals, sponges, echinoderms, and other mollusks, which can be damaged or killed by trawling. This decreases benthic productivity[113] and shifts community structure away from larger organisms (macroinvertebrates) to smaller organisms, reducing diversity of prey and negatively impacting fish stocks.[114]

Given the dearth of studies investigating impacts of trawling in Somali waters, we are left to draw lessons from other regions. Unregulated commercial trawling has occurred for at least four decades. Thus, the probability that considerable ecosystem damage has already occurred is high. Recovery times for trawl-impacted ecosystems vary widely depending on bottom type, but a global synthesis of trawling studies[115] showed that a 20% recovery could take over 8 years. A similar analysis[116] showed that ecosystem recovery generally took 500 days regardless of bottom type or gear used. For areas that are most heavily trawled, such as the waters around Ras Hafun in the northeast of Somalia (Figure 2.27), this could mean that the benthos and associated communities never have the chance to recover before being disturbed by a trawl again.

Promisingly, the new Somali Fisheries Law (Article 33.1) bans bottom trawling. This is an important first step toward stopping this destructive practice and allowing the affected marine communities to recover. Enforcing the ban will benefit marine habitat and improve fish stocks, increasing the sustainability and profitability of fishing for Somalis.

Despite the long history of foreign trawling in Somali waters, there has recently been intense local and international scrutiny of bottom trawling by the vessels flagged to or owned by companies from South Korea.[117] These large vessels have become emblematic of the negative effects of foreign fishing in Somali waters.[118,119,120,121] Because the Somali continental shelf is narrow, trawling in shallow water brings these vessels close to shore within view of coastal communities and Somali fishers, drawing attention to their activities.

The legality of the trawlers' presence prior to the declaration of the EEZ in 2014 was nebulous. Flagged to South Korea, these vessels had licenses that were issued by the government of Puntland. This highlights the need for consistency of fishing laws among the regions and with federal fisheries law. With the declaration of

FIGURE 2.27 Concentration (point density) of AIS broadcasts during trawling for five vessels, 2010–2014.

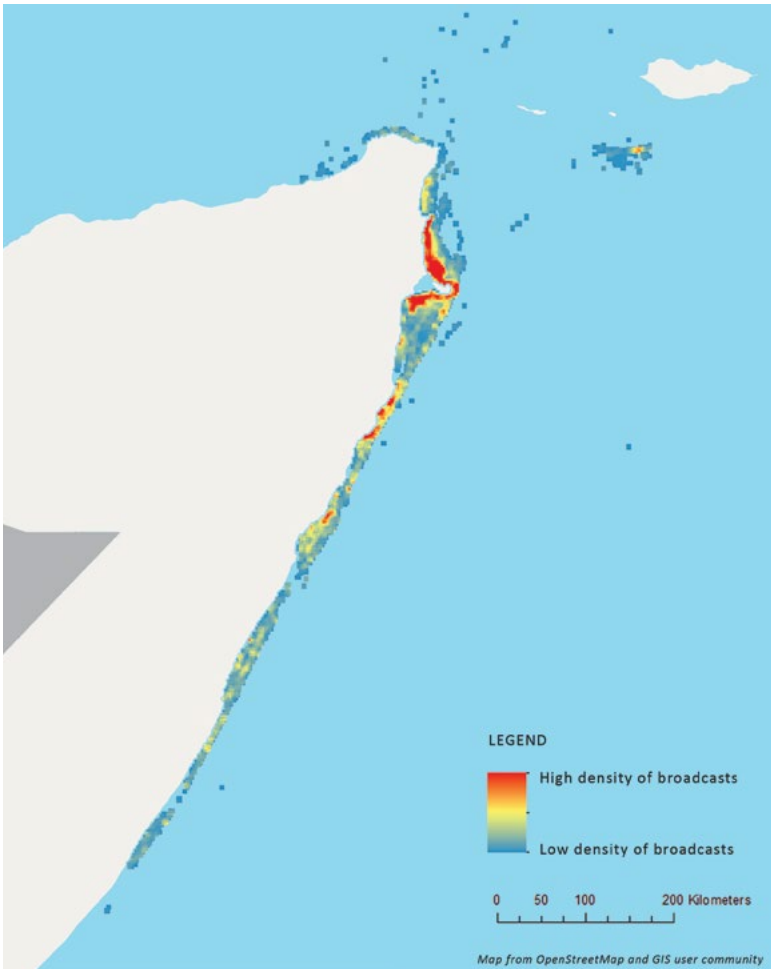
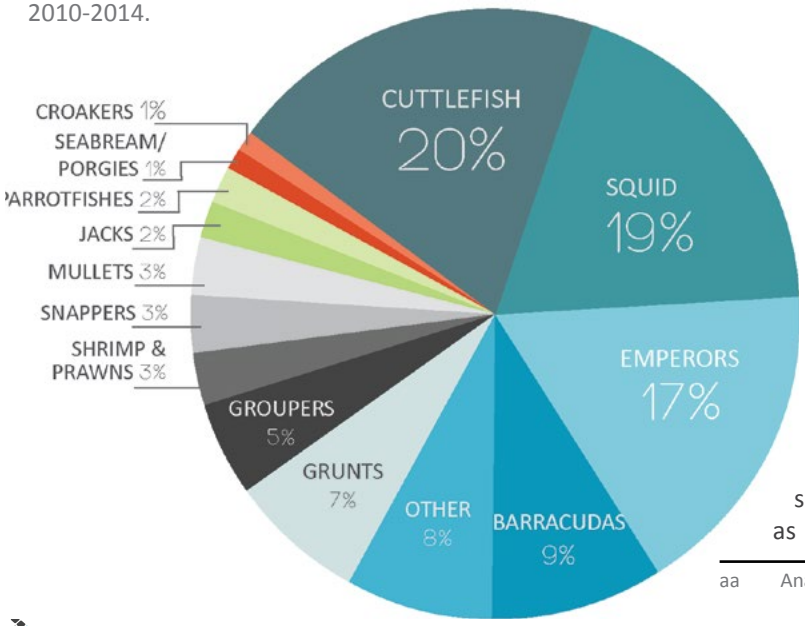


FIGURE 2.28 Composition of trawl catch by Korean vessels during 2010-2014.



the EEZ and the adoption of the new Somali Fisheries Law, trawling by these vessels is illegal in Somali waters. Some have attempted to capitalize on a perceived loophole by re-flagging to Somalia.[122] However, the ban on bottom trawling is not exclusive of domestic vessels, which means Somali flag or not, these vessels are operating illegally. This has recently been recognized internationally, by Oman, who, under the auspices of the Port State Measures Agreement, initially blocked some of these vessels from using the port of Salalah (but later, upon receiving licensing documents from Puntland, allowed the trawlers to land).[123]

5. POTENTIAL REVENUE GENERATION THROUGH LICENSING OF FOREIGN VESSELS[AA]

While unregulated foreign fishing negatively affects Somali fisheries, properly regulated and licensed foreign fishing may present opportunities. We estimate foreign vessels catch at least three times as much fish as the Somali domestic fleet, and the imbalance is even greater for high-value HMS (see Chapter 3). Given the highly competitive nature of global tuna fishing and the large scale of the companies engaged in it, coupled with the need for growth and technology in the Somali domestic fleet, it is unlikely that a nascent Somali tuna fleet will be competitive in the short term. A small-scale longline fleet, similar to the domestic tuna fisheries in La Rèunion or Mauritius, may be possible in the medium term (e.g., 10+ years). In the interim, however, licensing foreign tuna vessels is a potential source of revenue that could be used to bolster the Somali fisheries sector and its governance. Here, we estimate the revenue that could be gained from licensing foreign purse seine and longline vessels fishing for yellowfin, skipjack, or bigeye tuna in Somali waters.

5.1 Estimating Potential Revenue: Methodology

Potential license fee revenue from foreign purse seine and longline operations was estimated as a percentage of the annual gross market value

aa Analysis in Section 5 completed by MRAG.

of three commercially important tropical tuna species harvested in Somali waters: yellowfin, bigeye, and skipjack tuna. We multiplied annual catch of tuna (in metric tons) by the price commanded for a metric ton of tuna and applied a range of possible license rates.

The movement of foreign longline and purse seine fleets out of Somali waters (see Chapter 1 and §2 above) means recent years have not been representative of the full potential of tuna fishing in Somali waters. Before the threat of piracy peaked in 2011,[124] and before the expiration of EU purse seine agreements in 2006,[125] fishing for HMS by foreign boats was at much higher levels than in the following years. Given an expectation of a return to those conditions,[ab] we used catch by foreign tuna vessels during 2001–2005 as a baseline approximation for the amount of tuna fishing that could occur once proper licensing arrangements are secured and if piracy remains at or below 2014 levels.

Catch of tuna in metric tons (mt) was calculated from monthly catch of yellowfin, bigeye, and skipjack by purse seine and longline vessels estimated to be in Somali waters for the period 2001–2005 based on reports to the IOTC[ac] (see §3 above and Appendix 2 for detailed methods). Monthly global market prices ($US/mt)[ad] of yellowfin, bigeye, and skipjack tuna for the same period came from reported import values and varied for the two fisheries:[126,127] prices from Thailand for frozen yellowfin and skipjack were applied to purse seine landings, and prices from Japan for fresh bigeye and yellowfin were applied to longline landings (Table 2.3).[ae] Based on case studies of similar nations and contexts,[128] we assumed Somali authorities may charge a license fee revenue rate ranging from 2% to 10% of the gross value of tuna caught within Somali waters. The upper end of this range is relatively high when compared to most examples in the region, but Somali waters lie within some of the most productive fishing grounds in the Western Indian Ocean, and therefore they may be able to command these license fee rates.[129] See Appendix 4 for additional methodological details.

5.2 Value of Somali Tuna Fisheries and Potential Licensing Revenue

During 2001–2005, we estimate annual catch of yellowfin, bigeye, and skipjack tunas by IOTC-reporting longline and purse seine fleets within Somali waters ranged between 29,500 and 83,000 mt (on average, 54,291 mt). Applying the price of tuna during these same years (Table 2.3), this catch is valued at between US$38 million and US$121 million per year (US$94.9 million, on average) (Table 2.4). Assuming a licensing rate ranging between 2% and 10% of the total value, the potential annual revenue from licensing would range between US$1.9 million and US$8.4 million (Table 2.5). These values assume all catch was reported correctly to the IOTC and that all relevant vessels inside Somali waters would purchase a fishing license.

The market value of tuna in 2013 was considerably higher than in the early 2000s, particularly for longline-caught fish. If we assume catches inside Somali waters return to a level similar to that observed during 2001–2005, the estimated landed value of that catch using 2013 prices would have averaged US$173.4 million, with revenues from licensing ranging between US$3.5 million (at 2% return) and US$17.4 million (at 10% return).

TABLE 2.3 Price (import prices, $US) per mt of tuna used to estimate total values of tuna caught in Somali waters.

Species	Fishery	2001	2002	2003	2004	2005	2013
Yellowfin	Longline	$3,414	$3,438	$3,417	$3,887	$3,730	$9,421
Bigeye	Longline	$5,873	$5,028	$5,344	$6,098	$5,594	$9,644
Skipjack	Purse seine	$1,087	$1,036	$965	$1,170	$1,093	$2,040
Yellowfin	Purse seine	$1,336	$1,499	$1,493	$1,438	$1,565	$2,291

**Prices from 2001-2005 were used to estimate landings values and license revenue for catch made during 2001-2005 Prices for 2013 are presented for estimation of value and revenue possible under more recent market prices.*

Expected variability and uncertainty

When licensing schemes are based on market value of catch, revenue will vary with both catch volumes and prices. Variation in year-to-year catches (Figure 2.29) has been driven by at least three factors: migration of tuna, piracy, and access agreements. For example, during

ab In fact, the reduced threat of piracy in 2013 and 2014 has already correlated with higher levels of fishing activity in the region (see Figure 2.5).

ac We have focused only on tuna fishing by IOTC-compliant (reporting) vessels because they are the most likely to take advantage of legal licensing schemes.

ad Adjusted for inflation using the World Bank Consumer Price Index (CPI).

ae Derived from Thai and Japanese customs import datasets and COMTRADE website: http://comtrade.un.org/data/

TABLE 2.4 Estimated value ($US) of the catch of yellowfin, bigeye, and skipjack tuna caught in Somali waters by the foreign longline and purse seine fleets.

Fleet	2001	2002	2003	2004	2005
Longline	$29,780,393	$83,031,075	$74,838,950	$57,738,476	$34,595,906
Purse seine	$8,629,712	$15,840,676	$46,341,434	$60,718,410	$62,899,933
Total	**$38,410,105**	**$98,871,751**	**$121,180,384**	**$118,456,886**	**$97,495,839**

TABLE 2.5 Potential license fee revenues leveraged from the sale of fishing licenses to longline and purse seine vessels.

Fee rate	2001	2002	2003	2004	2005
2%	$768,202	$1,977,435	$2,423,608	$2,369,138	$1,949,917
5%	$1,172,886	$4,943,588	$6,059,019	$5,922,844	$4,874,792
8%	$3,072,808	$7,909,740	$9,694,431	$9,476,551	$7,799,667
10%	$3,841,010	$9,887,175	$12,118,038	$11,845,689	$9,749,584

2004–2005, tuna vessels experienced unusually large catches of yellowfin tuna in the waters of Tanzania and Kenya, which may have resulted in less fishing than usual in the Somali Basin during those years. The large decline in catches starting in 2006 was driven by a combination of these three factors, and the impact of any one of them on catch is not distinguishable in these data. However, tuna catches in Somali waters have increased rapidly since 2008. During the time period analyzed here (2001–2005), 83% of catch was produced by the purse seine fleet. Of the catch reported, 55% was skipjack, 31% was yellowfin, and 14% was bigeye tuna.

Since 2006, EU-flagged vessels have been prohibited under their relevant national legislations from fishing in Somali waters. It is important to note the volume of catch shown in Figure 2.29 contains significant uncertainty in allocation to Somali waters for reporting grid cells that border the Somali EEZ. Several of the important purse seine fleets, especially those of Spain and France, have reported fishing near the Somali EEZ, but not necessarily within it. From visualizations of their reported catch,[af] it is clear they have been "fishing the line" of the Somali EEZ. If companies for these two fleets enter into new licensing agreements with Somali authorities, we believe the data presented here represent a likely estimate of the variability in catch that could be expected in the future.

Our method of estimation includes several sources of uncertainty. First, as noted in §3 above, we have assigned catch that was reported in 1°×1° (purse seine) and 5°×5° (longline) resolution to Somali waters. These cells fell across the Somali EEZ boundaries, and we assumed catch was made uniformly throughout these cells. Additionally, because ex-vessel prices were not available, the total market values calculated (Table 2.4) are likely an overestimate as import prices are invariably higher than ex-vessel prices.[ag]

Licensing other fleets

Ultimately, the estimates presented here represent a baseline of license revenue possible in Somali waters. We have included data from the fleets most likely to obtain legal licenses in the near future. Catch from the countries that fish the most in Somali waters (Yemen and Iran) is not represented in the IOTC longline and purse seine catch-and-effort dataset (their catch is largely by gillnet vessels). Additionally, in the recent past, Egyptian mid-water trawlers have been licensed to fish in Somali waters. If industrial gillnet vessels and mid-water trawl vessels were also licensed, Somalia could earn revenue off the balance of foreign fishing.

The bottom line

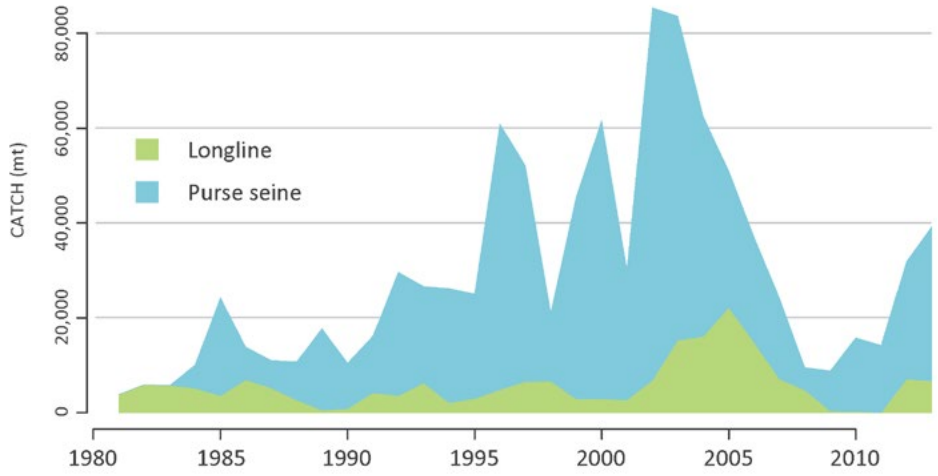
Even with uncertainty in the estimates of the tuna resource value presented here, the potential license revenue Somali authorities could earn is high and license fee revenues could be realized in the near future. Total catches of tropical tunas in Somali waters, and the northwest Indian Ocean more generally, have increased rapidly in recent years, primarily due to a reduction in the threat of piracy to fishing vessels. The increase in catch in and around Somali waters suggests foreign fishing fleets have resurrected their presence in the productive northwest Indian Ocean fishing grounds (i.e., Somali

af For detailed animations of Spanish and French fishing locations, seehttp://securefisheries.org/report/securing-somali-fisheries.

ag Noting the limitation of the methodology used in this analysis, it is perhaps more appropriate to calculate license fees as a proportion of the marginal benefit arising from fishing inside Somali waters, rather than as a proportion of the catch taken inside them. This is because the value to foreign fishers of obtaining a license arises from the difference between the catches that can be taken inside and those taken outside, rather than just the amount of catch taken from within. Unfortunately, such an analysis was not possible in this case given that vessel- and trip-specific data–held by fishing companies but not shared with the IOTC to preserve vessel confidentiality – were not available.

Basin area) relatively quickly. Purse seine vessels, which never left the northwest Indian Ocean entirely,[130] have recently had more freedom[ah] to search for tuna schools. Longline vessels, which generally avoided the northwest Indian Ocean region during the height of piracy, have started to return to these fishing grounds. This trend is expected to continue, and catches inside Somali waters may increase slightly or at least stabilize at current levels (excluding short term spikes). Increase in catch is most likely for the longline fishery because it was the most displaced by piracy and has not yet moved back into the region to the same extent as the purse seine fleet.

FIGURE 2.29 Estimated catch by longline and purse seine fleets of yellowfin, skipjack, and bigeye tuna in Somali waters. Data obtained from reports to the IOTC.



Somalia does face challenges to realizing the full potential of licensing. Transparency regarding the nature (e.g., levels of effort and catch) and benefits derived from foreign fishing agreements is low. This can make it difficult to ascertain whether the benefits from the fishing agreements are being maximized. In general, coastal states face a number of challenges in negotiating and enforcing fishing agreements. Their negotiating positions are often weakened by a combination of incomplete knowledge of the fish resources and their final market value, the benefits and costs associated with different policy options, lack of capacity to undertake fisheries assessments and gain market intelligence, and low capacity to monitor and enforce fisheries regulations.

Making access agreements publicly available can help overcome this challenge. If the terms of fishing agreements are in the public domain, it is possible to hold governments, vessels, and corporate entities accountable. Equally, only if the amount of catch and effort can be estimated from the terms of access agreements can the biological status of the fish stock be assessed. Fishing interests have been accused of underreporting catches in order to protect commercial interests and maintain advantages in negotiating agreements.[131] Increasing transparency in the sector would make it more difficult for fleets to perpetrate infractions of the arrangements and would allow immediate corrective action to be taken.

A regulatory framework to encourage and facilitate transparent licensing schemes will improve the economic benefits Somalia can extract from its natural resources. Weak management arrangements mean that the revenue generating potential of the resource cannot be fully realized. Without MCS and associated enforcement mechanisms, including port inspections, foreign vessels may exploit tuna resources within Somali waters illegally and reduce the returns available from the sale of licenses. However, the significant amount of tuna catch that is reported and that should be readily subject to licensing in the very near future is promising for Somalia. If widespread licensing of the foreign tuna fleets can be accomplished by the start of the 2016 tuna season, Somali fisheries authorities can begin building the coffers needed to invest in the domestic sector.

6. CONCLUSIONS

Fishery development in the Western Indian Ocean in general, and in Somali waters in particular, has lagged behind the rest of the world. However, WIO fisheries have expanded rapidly and the stagnation in fish catch suggests the species currently being targeted may not be able to support higher levels of fishing. The relatively unguarded Somali maritime domain has been an

ah For a short period in 2006–2007, the purse seine industry established a voluntary exclusion zone roughly corresponding to the Somali EEZ, and for a time French-flagged vessels were instructed to fish in pairs, disrupting their freedom to search for tuna schools.

attractive target for foreign fishing fleets. We estimate foreign vessels catch at least three times as much fish as Somalis do (around 132,000 mt in 2013)—and our estimates are decisively conservative. All of this catch is illegal, unregulated, or unreported. The consequences of rampant IUU foreign fishing in Somali waters are declining catch and profits for Somali fishers, habitat destruction, a loss of knowledge about the type of fish being caught, large amounts of bycatch, and physical injury to Somalis and their fishing gear.

We therefore conclude the major threat to Somali fisheries is IUU catch by foreign fleets. Somalis are losing millions of dollars each year to fishing by foreign vessels (Chapter 3). Furthermore, the health of Somali fish stocks is in jeopardy (Chapter 4). In order for Somali domestic fisheries to grow in a sustainable and profitable manner, the international community and national authorities must take swift action to reduce the presence of foreign IUU fishing in Somali waters.

REFERENCES

1 Sumaila, U. R., & Bawumia, M. (2014). Fisheries, ecosystem justice and piracy: A case study of Somalia. *Fisheries Research*, *157*, 154–163. Retrieved from doi:10.1016/j.fishres.2014.04.009

2 Weldemichael, A.T. (2012). Maritime corporate terrorism and its consequences in the western Indian Ocean: illegal fishing, waste dumping and piracy in twenty-first-century Somalia. *Journal of the Indian Ocean Region*, 8(2), 110–126. doi:10.1080/19480881.2012.730747

3 Lehr, P. and Lehmann, H. (2007). Somalia – Pirates' new paradise. In: P. Lehr (Ed.), *Violence at Sea: Piracy in the Age of Global Terrorism.* New York, NY: Routledge. doi:10.4324/9780203943489

4 Sumaila & Bawumia, Fisheries, ecosystem justice and piracy

5 Weldemichael, Maritime corporate terrorism and its consequences

6 Indian Ocean Tuna Commission. (2013). Examination of the effects of piracy on fleet operations and subsequent catch and effort trends (IOTC-2013-SC16-13[E]).

7 Oceans Beyond Piracy. (2014). *The State of Maritime Piracy Report 2014*. Denver, Colorado: One Earth Future Foundation.

8 Somalia: Fishermen protest against illegal fishing. (2015). *Horseed Media*. Retrieved from http://horseedmedia.net/2015/03/17/somalia-fishermen-protest-against-illegal-fishing/.

9 Food and Agriculture Organization of the United Nations. (2012). FishStatJ – software for fishery statistical time series. Retrieved from http://www.fao.org/fishery/statistics/software/fishstatj/en

10 Pauly, D., Watson, R., and Alder, J. (2005). Global trends in world fisheries: impacts on marine ecosystems and food security. *Philosophical Transactions of the Royal Society* B. 360: 5–12. doi:10.1098/rstb.2004.1574

11 United States Agency for International Development. (2014). Somalia economic growth strategic assessment: final assessment report. Washington, DC.

12 Pramod, G., Nakamura, K.,Pitcher, T.J., and Delagran, L. (2014) Estimates of illegal and unreported fish in seafood imports to the USA. *Marine Policy*. 48:102–113. doi:10.1016/j.marpol.2014.03.019

13 MRAG. (2012). *A review of bycatch in the Indian Ocean gillnet tuna fleet focusing on India and Sri Lanka*. Washington, D.C.: International Seafood Sustainability Foundation. Retrieved from http://iss-foundation.org/wp-content/uploads/downloads/2012/05/ISSF-2012-05-IO-Gillnet-Bycatch.pdf

14 Musse, G. H. and Tako, M. H. (1999). Illegal Fishing and Dumping Hazardous Wastes Threaten the Development of Somali Fisheries and the Marine Environments. In Tropical Aquaculture and Fisheries Conference 99, held on 7th–9th September 1999, Park Royal Hotel, Terengganu, Malaysia. Retrieved from http://www.mbali.info/doc236.htm.

15 Doulman, D. J. (2000) Illegal, Unreported, and Unregulated fishing: Mandate for an international plan of action. Rome: FAO. Retrieved from http://www.fao.org/docrep/005/Y3274E/y3274e06.htm#bm06

16 Food and Agriculture Organization of the United Nations. (2002). *Implementation of the International Plan of Action to Deter, Prevent and Eliminate Illegal, Unreported and Unregulated Fishing*. Rome, Italy.

17 Federal Republic of Somalia Ministry of Natural Resources. (2014). A Review of the Somali Fisheries Law (Law No. 23 of November 30, 1985), in accordance with Article 79, paragraph (d) of the Federal Constitution of Somalia.

18 Somalia profile-Timeline. (2015, 5 May). *BBC News*. Retrieved from http://www.bbc.com/news/world-africa-14094632

19 Agulhas and Somali Current Large Marine Ecosystems Project. (2010). *Coastal Livelihoods in the Republic of Somalia*. Retrieved from http://www.dlist.org/sites/default/files/doclib/Somalia%20Annex%20XI%20CLA%20final%20draft%2022-11-2010.pdf

20 Sumaila, U. R., & Bawumia, M. (2014). Fisheries, ecosystem justice and piracy: A case study of Somalia. *Fisheries Research*, *157*, 154–163. doi:10.1016/j.fishres.2014.04.009

21 Schbley, G., & Rosenau, W. (2013). *Piracy , Illegal Fishing , and Maritime Insecurity in Somalia, Kenya, and Tanzania*. Arlington, VA: CNA. Retrieved from https://www.cna.org/research/2013/piracy-illegal-fishing-maritime-insecurity-somalia

22 Murphy, M. N. (2011). *Somalia: the New Barbary? Piracy and Islam in the Horn of Africa*. New York, NY: Columbia University Press.

23 Lovatelli, A. (1996). *Artisanal Fisheries Final Report*. European Commission Rehabilitation Programme for Somalia. Nairobi, Kenya.

24 Somali Maritime Resource & Security Strategy Fisheries Working Group. (2014, April 6). Communique of the Somali MRSS Fisheries Working Group. Beau Vallon, Seychelles. Retrieved from http://oceansbeyondpiracy.org/sites/default/files/attachments/Apr%206%20Somali%20Fisheries%20Working%20Group%20Communique_0.pdf

25 Stromme, T. (1984). Cruise Report R/V "Dr. Fridtjof Nansen": second fisheries resource survey north-east coast of Somalia 24–30 August 1984. *Reports on Surveys*

with the R/V Dr Fridtjof Nansen. Bergen, Norway: Institute of Marine Research.

26 Agnew, D. J., Pearce, J., Pramod, G., Peatman, T., Watson, R., Beddington, J. R., & Pitcher, T. J. (2009). Estimating the worldwide extent of illegal fishing. *PloS One*, *4*(2), e4570. doi:10.1371/journal.pone.0004570

27 Pitcher, T. J., Watson, R., Forrest, R., Valtysson, H. P., & Guénette, S. (2002). Estimating illegal and unreported catches from marine ecosystems: a basis for change. *Fish and Fisheries*, *3*(4), 317–339. doi:10.1046/j.1467-2979.2002.00093.x

28 African Development Solutions. (2015). *Illegal Unreported and Unregulated (IUU) Fishing in the Territorial Waters of Somalia*. Nairobi, Kenya.

29 Katz, A. (2012). Fighting piracy goes awry with killings of fishermen. *Bloomberg Business*. Retrieved from http://www.bloomberg.com/news/articles/2012-09-16/fighting-piracy-goes-awry-with-killings-of-fishermen

30 Somaliland seizes Yemeni and Egyptian vessels. (2014, December 17). *BBC*. Retrieved from http://www.bbc.com/news/world-africa-30513110

31 Oceans Beyond Piracy. (2015). OBP issue paper: Will illegal fishing ignite a preventable resurgence of Somali piracy? Retrieved from http://obp.ngo/sites/default/files/attachments/OBP%20Issue%20Paper%20-%20Fishing%20Boat%20Hijackings%20off%20Somalia.pdf

32 Somali's Shabaab holds Iran fishing boat. (13 May 2015). *World Bulletin/News Desk*. Retrieved from http://www.worldbulletin.net/todays-news/159123/somalias-shabaab-holds-iran-fishing-boat

33 Indian Ocean Tuna Commission. (2015). Report on presumed IUU fishing activities in the EEZ of Somalia (IOTC-2015-S19-Inf01). Busan, Korea. Retrieved from http://www.iotc.org/documents/report-presumed-iuu-fishing-activities-eez-somalia

34 Ibid.

35 Auditor-general breaks silence over illegal fishing. (2015, January 23). *Somali Agenda*. Retrieved from https://somaliagenda.com/auditor-general-breaks-silence-illegal-fishing/

36 Sumaila, U. R., Alder, J., & Keith, H. (2006). Global scope and economics of illegal fishing. *Marine Policy*, *30*(6), 696–703. doi:10.1016/j.marpol.2005.11.001

37 Miller, D.D., and Sumaila, U.R. (2014). Flag use behavior and IUU activity within the international fishing fleet: Refining definitions and identifying areas of concern. *Marine Policy*, 44, 204–211. doi:10.1016/j.marpol.2013.08.027

38 Flothmann, S., Kistowski, K., Dolan, E., Lee, E., Meere, F., and Album, G. (2010). Closing loopholes: Getting illegal fishing under control. *Science*, 328, 1235–1236. doi:10.1126/science.1190245

39 Ibid.

40 Rigg, K., Parmentier, R., Currie, D. (2003). Halting IUU fishing: Enforcing international fisheries agreements. The Varda Group. Retrieved from http://www.imcsnet.org/imcs/docs/halting_iuu_fishing_oceana.pdf

41 Gianni, M. and Simpson, W. (2005). *The Changing Nature of High Seas Fishing: how flags of convenience provide cover for illegal, unreported and unregulated fishing*. Australian Department of Agriculture, Fisheries and Forestry, International Transport Workers' Federation, and WWF International.

42 Musse and Tako, Illegal fishing and dumping

43 Pitcher, T. J., Watson, R., Forrest, R., Valtysson, H. P., and Guenette, S. (2002). Estimating illegal and unreported catches from marine ecosystems: a basis for change. *Fish and Fisheries*, 3,317–339. doi:10.1046/j.1467-2979.2002.00093.x

44 Indian Ocean Tuna Commission. (2010) Resolution 08/01 Mandatory statistical requirements for IOTC Members and Cooperating Non-Contracting Parties. Retrieved from http://www.iotc.org/cmm/resolution-1002-mandatory-statistical-requirements-iotc-members-and-cooperating-non-contracting.

45 Pauly, D., Belhabib, D., Blomeyer, R., Cheung, W. W. W. L., Cisneros-Montemayor, A. M., Copeland, D., … Zeller, D. (2014). China's distant-water fisheries in the 21st century. *Fish and Fisheries*, *15*(3), 474–488. doi:10.1111/faf.12032

46 Sea Around Us. Catch reconstruction and allocation methods. Retrieved from http://www.seaaroundus.org/catch-reconstruction-and-allocation-methods. Accessed 6/15/2015, updated 30 July 2015.

47 Indian Ocean Tuna Commission. (2008). Updated analysis of the SFA 2008 PS data: 2008 effects of the closed area in Somalia (IOTC-2008-SC-INF27). Retrieved from http://www.iotc.org/documents/updated-analysis-sfa-2008-ps-data-2008-effects-closed-area-somalia

48 Davies, T.K., Mees, C.C., Milner-Gulland, E.J. (2014). The past, present and future use of drifting fish aggregating devices (FADs) in the Indian Ocean. *Marine Policy*, 45, 163–170. doi:10.1016/j.marpol.2013.12.014

49 Chassot, et al. (2010). Analysis of the effects of Somali piracy on the European tuna purse seine fisheries of the Indian Ocean (IOTC-2010-SC-09). Report to the IOTC Scientific Committee.

50 Oceans Beyond Piracy, *The State of Maritime Piracy*

51 Waugh, S.M., Filippi, D.P., Blyth, R., and Filippi, P.F. (2011). Assessment of bycatch in gillnet fisheries. Report to the Convention of Migratory Species. Retrieved from http://www.cms.int/en/document/assessment-bycatch-gill-net-fisheries

52 United Nations Security Council. (2013, July 12). Report on Somalia of the Monitoring Group on Somalia and Eritrea (S/2013/413). Retrieved from http://www.securitycouncilreport.org/atf/cf/%7B65BFCF9B-6D27-4E9C-8CD3-CF6E4FF96FF9%7D/s_2013_413.pdf.

53 Somalia: Puntland seizes five illegal fishing boats, 78 Iranians arrested. (2013, April 24). *All Africa/ Garowe Online*. Retrieved from http://allafrica.com/stories/201304250101.html

54 United Nations Security Council, Report on Somalia

55 Indian Ocean Tuna Commission. (2015). Report on presumed IUU fishing activities in the EEZ of Somalia (IOTC-2015-S19-Inf01). Busan, Korea. Retrieved from http://www.iotc.org/documents/report-presumed-iuu-fishing-activities-eez-somalia

56 Waugh et al., Assessment of Bycatch in Gillnet Fisheries

57 Pauly et al., China's distant-water

58 Indian Ocean Tuna Commission, Report on presumed IUU

59 Yassin, M. (1981). Somalia: Somali fisheries development and management. Retrieved from http://ir.library.oregonstate.edu/dspace/bitstream/1957/6400/1/Mohamed_Yassin_ocr.pdf.

60 Ibid.

61 J. Million (personal communication, February 24, 2015).

62 MRAG, *A review of bycatch*

63 UN News Service. (2015, April 15). Millions of Yeminis face food insecurity amid escalating conflict, UN agency warns. *UN News Centre*. Retrieved from http://www.un.org/apps/news/story.asp?NewsID=50584#.VXhNgWAipFJ

64 Nur, H.A. (2006, February 20). Somaliland says arrests 84 Yemeni fishermen. *Reuters*. Retrieved from http://www.planetark.org/dailynewsstory.cfm/newsid/35201/story.htm

65 United Nations Security Council. (2013). Report of the Monitoring Group on Somalia and Eritrea pursuant to Security Council Resolution 2060 (2012) (S/2013/413). Retrieved from http://www.un.org/ga/search/view_doc.asp?symbol=S/2013/413

66 Kulmiye, A. (2010). *Assessment of the status of the artisanal fisheries in Puntland through value chain analysis*. VSF Suisse and UNDP.

67 U.S. aircraft carrier sent to Yemen in response to Iran. (2015, April 20). *CBS News*. Retrieved from http://www.cbsnews.com/news/us-aircraft-carrier-sent-to-yemen-in-response-to-iran-convoy/

68 Iran raises the stakes in Yemen faceoff. (2015, April 8). *CBS News*. Retrieved from http://www.cbsnews.com/news/iran-warship-gulf-of-aden-yemen-sunni-saudi-arabia-bombs-shiite-houthi/

69 Yassin, Somalia: Somali fisheries

70 Berbera and Maritime Fisheries Academy. (2013). *Business Plan*. Berbera, Somaliland.

71 Anon. (2012). Summary report FAO TCPF fisheries mission to Somaliland and Puntland (2505/R/01D).

72 Government of Somaliland Ministry of Trade and Investment. (2014). *An Investment Guide to Somaliland Opportunities and Conditions 2013–2014*. Retrieved from http://somalilandinvest.net/somaliland_investment_guide.pdf

73 Toxic waste behind Somali pirates. (2010, 8 May). *Project Censored*. Retrieved from http://www.projectcensored.org/3-toxic-waste-behind-somali-pirates/.

74 Somaliland seizes Yemeni and Egyptian vessels. (2014, 17 December). *BBC News*. Retrieved from http://www.bbc.com/news/world-africa-30513110.

75 Bihi, A. I. (1984). *L ' impact potentiel des activites socio-economiques sur l ' environne- ment marin et côtier de la region de l'Afrique de l ' Est : Rapports nationaux*. Mers Regionales. Programme des Nations Unies Pour L'Environment, pp. 1–17.

76 Ibid.

77 Van Zalinge, N. P. (1988). Summary of fisheries and resources information for Somalia. Rome: FAO.

78 Somali Democratic Republic Ministry of Fisheries and Marine Transport. (1988). Yearly fisheries and marine transport report 1987/1988. Mogadishu, Somalia.

79 SHIFCO. (1998, November 18). *Final Mission Report, Somalia*. Retrieved from http://ec.europa.eu/food/fs/inspections/vi/reports/somalia/vi_rep_soma_1522-1998_en.pdf. Accessed 15 October 2014.

80 J. Million (personal communication, February 24, 2015).

81 MRAG, *A review of bycatch*

82 Gillett, R. (2011). Bycatch in small scale tuna fisheries: a global study. FAO Fisheries and Aquaculture Technical Paper No. 560. Rome.

83 S. Akester (personal communication, July 5, 2015).

84 Puntland State of Somalia Office of Coast Guard Forces. (2006, March 3). Letter to the Supreme Court of Royal Thai Government, subject: Release of Somali nationals detained in Thailand. http://www.somalitalk.com/2006/thailand/letter2.pdf

85 Fry, E. (2009, March 29). Fishing for trouble. *Bangkok Post*.

86 United Nations Security Council, Report on Somalia

87 Persson, L., Lindop, A., Harper, S., Zylich, K. and Zeller, D. (2015). Failed state: reconstruction of domestic fisheries catches in Somalia 1950–2010. Pp. 111–127 *In* F. Le Manach and D. Pauly (Eds.) *Fisheries catch reconstructions in the Western Indian Ocean, 1950–2010*.

Fisheries Centre Research Reports 23(2). Fisheries Centre, University of British Columbia [ISSN 1198–6727].

88 Pauly et al., China's distant-water

89 Indian Ocean Tuna Commission, Report on presumed IUU

90 Haakonsen, J. M. (1983). Somalia's Fisheries Case Study. In *Case Studies and Working Papers Presented at the Expert Consultation on Strategies for Fisheries Development* (pp. 170–184). Rome.

91 Bihi, A. I., *L ' impact*

92 MarineTraffic.com. Retrieved from http://www.marinetraffic.com/ais/details/ships/shipid:905264/mmsi:-8615679/imo:8615679/vessel:GREKO_1. Accessed 11 August 2015.

93 Bocha, G. (2012, February 18). Fishermen living in near destitution since October ban. *The Daily Nation*. Retrieved from http://www.nation.co.ke/news/Kenyan-fishermen-living-in-near-destitution/-/1056/1330558/-/ft4ick/-/index.html

94 Waldo, M. A. (2014, January 8). The two piracies: why the world ignores the other? *WardheerNews.com*. Retrieved from http://wardheernews.com/Articles_09/Jan/Waldo/08_The_two_piracies_in_Somalia.html http://wardheernews.com/Articles_09/Jan/Waldo/08_The_two_piracies_in_Somalia.html

95 Megalommatis, M. (2008, December 8). Somali piracy – the other side. *Ocnus.net*. http://www.ocnus.net/artman2/publish/Analyses_12/Somali_Piracy_-_The_Other_Side.shtml

96 Jennings, T.M. (1998). Marine living resource governance in the absence of a central authority: A study of Somalia (Master's thesis). University of Washington, Seattle, Washington.

97 Perera, M. (2012, April 27). Six Sri Lankan fishermen held by Somali pirates are rescued. *AsiaNews*. Retrieved from http://www.asianews.it/news-en/Six-Sri-Lankan-fishermen-held-by-Somali-pirates-are-rescued-24607.html

98 Fernando, S. (2011, February 2). Sri Lankan fishermen killed by Somali pirates. *Asian Tribune*. Retrieved from http://www.asiantribune.com/news/2011/02/01/sri-lankan-fishermen-killed-somali-pirates

99 Indian Ocean Tuna Commission. (2014). IUU Fishing in BIOT waters by fishing vessels flagged in Sri Lanka. (IOTC-2014-CoC-11-08b[E]).

100 Marine Fisheries Census 2010. Central Marine Fisheries Research Institute, Kochi. Ministry of Agriculture, Government of India. http://eprints.cmfri.org.in/8998/

101 Indian Ocean Tuna Commission. Vessels. Retrieved from http://www.iotc.org/vessels Accessed 24 June 2015.

102 J. Million (personal communication, February 24, 2015) and M. Kroese (personal communication, February 10, 2015).

103 Somaliland Territorial Sea, Contiguous Zone & Exclusive Economic Zone. Retrieved from http://www.somalilandlaw.com/territorial_sea_and_waters.htm

104 Somali Democratic Republic Ministry of Fisheries and Marine Resources. (1985). Guidelines for fisheries joint venture with foreign partners. Retrieved from http://faolex.fao.org/docs/pdf/som2144.pdf

105 nterview with Augusto Spina, *PanaPesca SpA,* 24 October, 2014. Conducted by Andy Hickman. Pisa, Italy.

106 www.vesselfinder.com

107 Hiddink, J.G., Jennings, S., Kaiser, M.J., Queiros, a.M., Duplisea, D.E., & Piet, G.J. (2009). Cumulative impacts of seabed trawl disturbance on benthic biomass, production, and species richness in different habitats, 736, 721–736. doi:10.1139/f05-266

108 Interview with Augusto Spina

109 *Report on Cruise No . 5 of R / V " Dr. Fridtjof Nansen" - Indian Ocean Fishery and Development Programme - Pelagic Fish Assessment Survey North Arabian Sea*. (1976). Bergen, Norway: Institute of Marine Research.

110 Stromme, *Cruise Report R/V "Dr. Fridtjof Nansen"*

111 Alverson, D.L., Freeberg, M.H., Pope, J.G., Murawski, S.A. (1994). *A global assessment of fisheries bycatch and discards* (FAO Fisheries Technical Paper No. 339). Rome: FAO.

112 Pilskaln, C. H., Churchill, J. H., & Mayer, L. M. (1998). Resuspension of sediment by bottom trawling in the Gulf of Maine and potential geochemical consequences. *Conservation Biology*, *12*(6), 1223–1229. doi:10.1046/j.1523-1739.1998.0120061223.x

113 Kaiser, M. J., Clarke, K. R., Hinz, H., Austen, M. C. V, Somerfield, P. J., & Karakassis, I. (2006). Global analysis of response and recovery of benthic biota to fishing. *Marine Ecology Progress Series*, 311(2000), 1–14. doi:10.3354/meps311001

114 Dayton, P. K., Thrush, S. F., Agardy, M. T., & Hofman, R. J. (1995). Environmental effects of marine fishing. *Aquatic Conservation: Marine and Freshwater Ecosystems*, 5(March), 205–232. Retrieved from doi:10.1002/aqc.3270050305

115 Kaiser et al., Global analysis

116 Collie, J. S., Hall, S. J., Kaiser, M. J., & Poiner, I. T. (2000). A quantitative analysis of fishing impacts on shelf-sea benthos. *Journal of Animal Ecology*, 69 (5), 785–798, (785-798). doi:10.1046/j.1365-2656.2000.00434.x

117 Indian Ocean Tuna Commission, Report on presumed IUU

118 Kulmiye, Militia vs Trawlers

119 Coastal Development Organization. (2013). *Illegal fishing by foreign trawlers looms across Somalia*.

120 Somalia, Report on presumed IUU

121 S. Akester (personal communication, February 9, 2015).

122 Indian Ocean Tuna Commission, Report on presumed IUU

123 EJF: Oman takes decisive port measures to block suspect fishing vessels. (2015, May 22). *Undercurrent News*. Retrieved from http://www.undercurrentnews.com/2015/05/22/ejf-oman-takes-decisive-port-measures-to-block-suspect-fishing-vessels/

124 Oceans Beyond Piracy, *State of Maritime Piracy*

125 Chassot, et al. (2010). Analysis of the effects of Somali piracy on the European tuna purse seine fisheries of the Indian Ocean (IOTC-2010-SC-09). Report to the IOTC Scientific Committee.

126 Jeon, Y., Reid, C., & Squires, D. (2008). Is There a Global Market for Tuna? Policy Implications for Tropical Tuna Fisheries. *Ocean Development & International Law*, 39(1), 32–50. doi:10.1080/00908320701641594

127 Miyake, M., Guillotreau, P., Sun, C.-H., & Ishimura, G. (2010). Recent developments in the tuna industry: Stocks, fisheries, management, processing, trade and markets. Food and Agriculture Organization of the United Nations, Rome, Italy.

128 Barnes, C. & Mfodwo, K. (2012). A market price evaluation of tuna resources in the Western Indian Ocean – and indicative regional and country/EEZ perspective. Gland, Switzerland: WWF.

129 Davies, T. K., Mees, C. C., & Milner-Gulland, E. J. (2014). The past, present and future use of drifting fish aggregating devices (FADs) in the Indian Ocean. *Marine Policy*, 45, 163–170. doi:10.1016/j.marpol.2013.12.014

130 Floch, L., Molina, A.D.D., Assan, C., Dewals, P., Areso, J.J., & Chassot, E. (2012). Statistics of the European purse seine fishing fleet and associated flags targeting tropical tunas in the Indian Ocean (1981–2011). Indian Ocean Tuna Commission document IOTC-2012-WPTT-14 21.

131 Kaczynski, V. M., & Fluharty, D. L. (2002). European policies in West Africa: who benefits from fisheries agreements? Marine Policy, 26(2), 75–93. doi:10.1016/s0308-597x(01)00039-2

CHAPTER 3. ECONOMIC VALUE OF SOMALI DOMESTIC FISHERIES

Fisheries contribute critically to income and food security. During the past few decades, fisheries have played an ever-increasing role in nutrition in developing nations: apparent per capita fish consumption in low income food-deficit countries grew from 4.9 kg to 10.9 kg between 1961 and 2010.[1] In Africa, fisheries are an important part of local and regional economies, adding over US$24 billion to the continental economy.[2] Yet, small-scale fishers remain some of the most impoverished people in the world and are highly vulnerable to economic shocks and the resulting livelihood insecurity.[3]

The global marketplace for fisheries commodities has diversified and expanded. Developed nations are importing high-value fish (e.g., tuna) from developing nations, while developing nations are importing low-value fish (e.g., sardines). The negative effects of this trade imbalance are exacerbated by a North-South divide in fisheries investment and a growing risk of conflict over fisheries resources between developed and developing nations.[4] For example, in contrast to global trends, apparent per capita fish consumption has actually declined in Sub-Saharan Africa since 1990.[5] The benefits earned from fisheries are increasingly unequally distributed, and small-scale fishers are bearing the brunt of declining resources, competition from a technologically advanced global distant water fishing fleet, and structural policies that entrench inequality.[6]

Small-scale fisheries in Somalia are facing similar problems. Our conversations with Somali fishers reveal growing concern over the state of the resource, lost profits attributed to competition from foreign industrial vessels, and a lack of access to formal markets. Despite having some of the most productive waters on Earth (see Chapter 4), small-scale fisheries in Somalia are relatively under-developed compared to neighboring countries. Nevertheless, fisheries have the potential to be an important source of food and income security and, eventually, of stability, in Somalia.

National-level statistics are outdated, but the most recent numbers available document 4,500[a] full-time and 5,000 part-time fishers across Somalia.[7,8] In 1996, fisheries indirectly employed an additional 30,000 persons full-time and 60,000 part-time in occupations such as gear repair, cold chain supply, and processing.[9] In the late 1980s, when fisheries were undergoing growth and investment, the export of fishery products was valued at US$15 million per year.[10] However, the declining state of domestic fisheries after the civil war caused fishery export value to plummet to US$3.3 million.[11] More recently, the economic importance of the Somali fisheries sector has been growing, with increased attention on the potential of the sector to contribute to development.[12]

The contribution of fisheries to food and income security in Somalia is not known. Annual per capita fish consumption appears low compared to global averages (around 2 kg compared to 17 kg globally).[13] This reflects a traditional non-fish meat diet and underdeveloped domestic markets. However, a survey conducted in 2014 reveals fish consumption in the homes of Somali fishers is much greater than this national average.[14] The domestic fish market is by no means uniform. Markets for fish are more developed in larger, coastal, urban areas (Mogadishu, Bosaso, and Berbera) where more people buy fish for processing and for export. Outside these areas, most fish is consumed directly or is exchanged in barter rather than sale.

Few studies have estimated the value of domestic fish and fish products throughout the value chain, and those estimates that exist focus on particular fisheries (e.g., spiny lobster[15]) or supply and value chains in particular regions (e.g., Puntland[16] or Somaliland[17, 18]). Here, we seek to quantify the value of fish and fish products landed by the Somali domestic fishing fleet. Information on the key actors, value of fish and fish products, processing, storage, and transport were collated to form value chain diagrams for three fisheries: finfishes, sharks, and lobsters. The landed value of fish caught by the domestic fishing fleet was estimated using first-point-of-sale prices. Finally, the total value of fish landed by the artisanal sector was estimated using an economic multiplier.

Tuna caught in Somali waters, Jean-Pierre Larroque

a But see more recent estimates for Puntland that indicate higher numbers of fishers (§1.3).

Box 3.1: Violence Against Somali Fishers

In Somali waters, conflict with industrial (especially foreign) vessels threatens the livelihoods and wellbeing of Somali artisanal fishers. Although the full scale of the problem has not been documented systematically, Somali fishers frequently speak out about the risks posed by commercial vessels fishing within 12 nautical miles of shore, where they are likely to encounter local vessels. These risks include collisions that destroy or seriously damage smaller vessels, destruction of fishing equipment, and the use of targeted violence to gain access to fishing grounds. In some cases collisions and destruction of equipment may be accidental, such as when a commercial vessel overruns a small, unlit dhow at night. In other cases, however, it can be intentional. A fisher in Puntland argued, "Our job is in jeopardy…we have been several times chased by them [Yemeni vessels], which are illegally taking our sea resources. And we have submitted our complaints to our authority. They are not just robbing our fish. They are ramming our boats and taking our nets."[19]

Regardless of the intent, interactions between artisanal and industrial fishing vessels can seriously harm Somali fishers. A collision can leave fishers stranded at sea. Damage to either the vessel or fishing equipment will prevent fishing until the damaged item is repaired or replaced. Because the offending foreign vessels do not enter ports in Somalia, there are no mechanisms in place to hold them responsible for the costs incurred by Somalis.[20]

A lack of effective reporting systems exacerbates the problem. Somali fishers have neither a reporting body that documents confrontations with industrial or commercial vessels nor a national coast guard to provide support and rescue services. This makes it difficult to determine the frequency and severity of violence that Somali fishers face from industrial fleets in their waters. Increased reporting on these conflicts would increase understanding of the risks that industrial fishing poses to artisanal fishers. It would also facilitate effective management of foreign vessels based on the feedback received from Somalis, and could provide an avenue for compensation to Somali fishers via licensing fees or penalties.

1. DOMESTIC AND EXPORT MARKETS FOR SOMALI FISH PRODUCTS

The market structure of fisheries commodities that are landed by the domestic fleet shows significant opportunity for growth and development, both within Somalia and to export markets. Figure 3.1 summarizes movements of fish caught by the domestic fleets and the immediate export destinations for Somali fish and fish products. Export paths are complicated by factors such as re-exporting and individual exporter-supply relations. Value chain diagrams (Figures 3.4–3.6) show a more detailed list of export destinations for specific fisheries (e.g., finfish, sharks, lobsters).

Domestic landings of fish are primarily consumed locally in coastal areas, but movement to larger inland cities also occurs.[21, 22, 23, 24] Fresh fish is sold either directly on the beach or in nearby markets. In localities with access to ice, fish traders sell to inland communities to satisfy demand.[25, 26] Approximately 4,000 mt of fish commodities were exported in 2009, worth around US$3.1 million. In Puntland, lobsters, some shark products, and fish are collected and transported from numerous landing locations to trade hubs or exporting towns (e.g., Bosaso, Garowe, Galkayo) (represented by black arrows in Figure 3.1) where the product is sold on the market or exported by local traders to countries in the Middle East or Asia and then onwards internationally.

Artisanal fishers operating in Somaliland (Zeila) sell much of their catch to markets in Djibouti through informal arrangements. In 2004, 2.5–3 mt of fresh fish were exported to Djibouti per day, making yearly supply (assuming a 9-month fishing season) around 800 mt. Export to Ethiopia and Middle Eastern markets is also a viable option, but it is not clear if these export markets have been developed by domestic fishers and traders.[27] Finally, fish that may not enter formal export markets is transshipped from Somali fishers to foreign vessels at sea, often bypassing landing procedures. For example, in 2005 51 Yemeni vessels were involved in transshipping activity in the Puntland region, creating an important market for Somali fishers (see Chapter 2 Box 2.3).[28]

In large cities such as Hargeisa, demand often exceeds local supply, and imports of canned fish make up the

balance.[29] Fisheries imports grew rapidly between 2005 and 2009, from 295 mt to 1,431 mt respectively, and they were valued at around US$5.5 million (2009 prices). Canned tuna makes up the largest proportion of imports and is popular and available through many food retail shops in urban areas. However, it tends to be expensive and therefore out of reach for poorer households.[30]

1.1 Domestic Fishery Overview

The Somali domestic fishing sector is primarily artisanal, with subsistence and industrial fishing occurring to varying degrees. Important fisheries include those for spiny lobster, demersal reef fishes such as groupers and emperors, and sharks and rays (Figure 3.2). Most catch is made by gillnets, although handlines and traps are also commonly employed. Because these are operated out of small boats, fishing is limited to areas close to shore and during calm seas, generally during nine months of the year (September–May). According to surveys of Somali fishers conducted by Secure Fisheries, fishing season varies among regions, fishers, and target species (Appendix 1).

Fisheries in all regions face significant challenges to development. The lack of infrastructure, especially ice, freezing, and cold storage facilities, is a major limiting factor to the expansion of the sector. This makes storage, transportation, and distribution of fish difficult. Most vessels (95% in Puntland[31]) lack on-board ice for preserving fish, and spoilage and waste is a key market concern. A lack of proper landing facilities is another impediment. Most catch by artisanal fishers is landed on beaches, sometimes far from cold storage. The transportation of catch is further hampered by the lack of paved roads across the country.[32] More details on nationwide fishing sector background are developed in Chapter 1 §4.

Recently, the Sea Around Us at the University of British Columbia undertook a catch reconstruction of Somali domestic fisheries.[33] Reconstructions are useful when catch is known to be unreported or underreported. The Somali Ministry of Fisheries maintained and reported national records of fish catch during 1974–1987, and these were reported to the UN Food and Agriculture Organization (FAO). Since 1987, the FAO has estimated fish catch coming from Somali domestic fisheries. The Sea Around Us used the period of reported catch as a baseline. They assimilated a significant amount of information about Somali fisheries through data archives, interviews with experts, and media reports. Estimates of number of fishing boats, catch rates, and catch species composition were key inputs to the reconstruction. Reports of the number of fishing boats acted as anchor points at various points in time, and catch was extrapolated forward and backward from the reporting period. For the most recent estimates, regional reports of catch from 2004[34] and 2005[35, 36] were

FIGURE 3.1 Major domestic (black) and export (red) flows of Somali fisheries commodities.

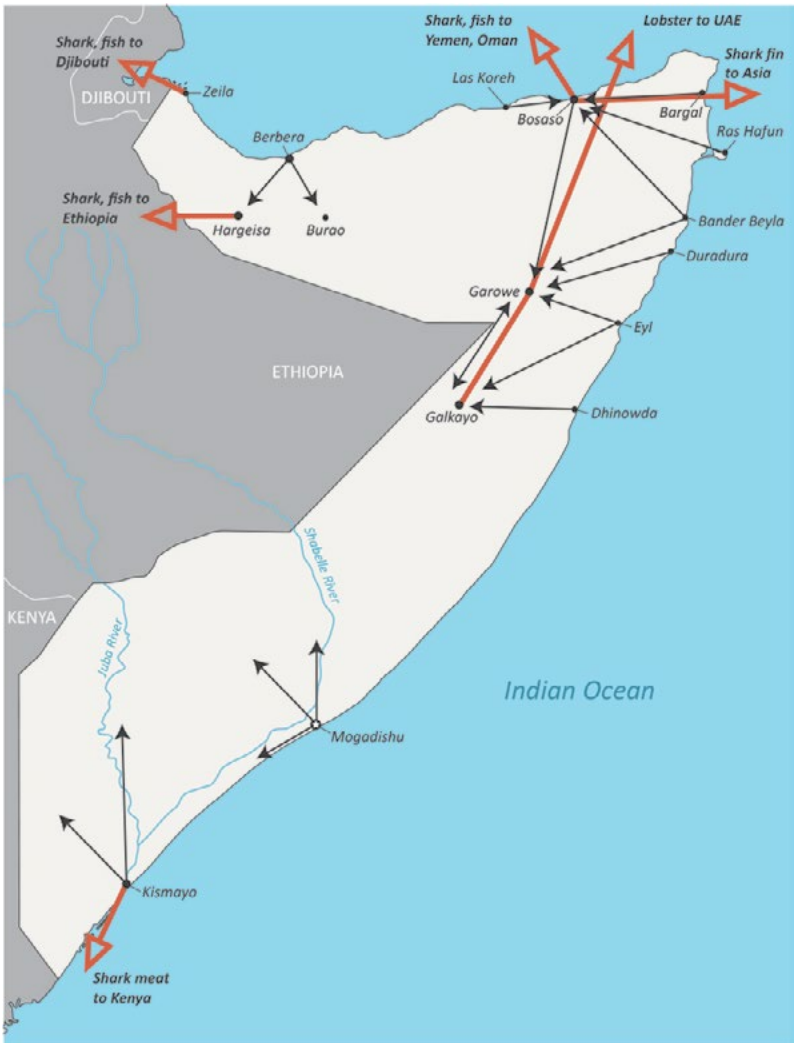
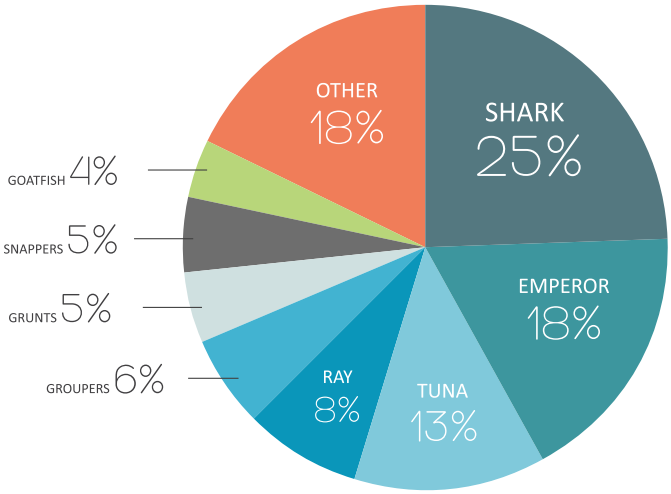


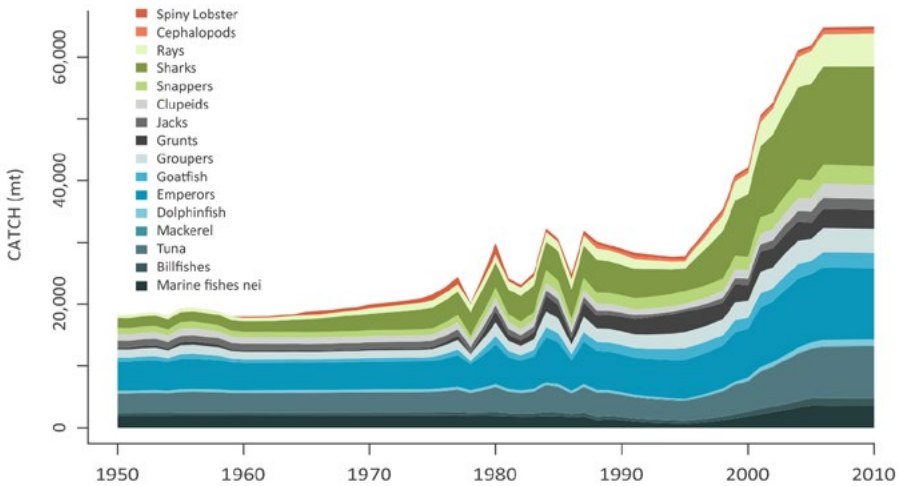
FIGURE 3.2
Catch composition of Somali domestic fisheries.



used to estimate catch from 2005–2010. Estimates of fishery discards were further added to estimates of landings. Methodological details are contained in Persson et al.[37]

The Sea Around Us estimates catch by Somali fisheries increased dramatically from the mid-1980s to today, growing from approximately 30,000 mt per year to around 65,000 mt per year in 2010 (Figure 3.3).[b] Reconstructed catch is nearly twice that estimated by the FAO in their public databases.[c] An estimated 55,000 mt of fish and shellfish were landed (reported and unreported landings, excluding discards) by Somali fishers in 2010.[38] Of this, 32,500 mt of fish were landed domestically by artisanal fishers, 8,000 mt by subsistence fishers, and 14,500 mt by the industrial sector.

FIGURE 3.3 Catch by Somali domestic fisheries.



1.2 Somaliland Region

Artisanal fishers in Somaliland target finfish (pelagic and demersal), sharks, lobster, prawns, crabs, and sea cucumber.[39] The main gears used by this sector include gillnets, hooks (for large fish and sharks), hand lines, and some traps and seine nets.[40] Fish are caught for personal consumption, for sale upon landing at the beach, or for transport to Hargeisa and for export. However, the capacity for freezing is small and more freezers and ice machines would improve the profitability of exporting fish from the region.[41]

Artisanal fishers operate on a permanent basis from 15 coastal settlements, and the main ports and landing sites are in Zeila, Berbera, and Las Koreh. Artisanal landings from around Berbera supply local markets in Erigao, Las Anod, Burao, Berbera, Hargeisa, Gabiley, and Borama.[42] Though current data are lacking, in 2004 there were between 450 and 500 small fishing vessels operating in the Somaliland artisanal fishery, of which two-thirds were motorized. There are an estimated 2,625 full and part-time fishers in the region.[43] There are two boat-building facilities in Somaliland—Gamuur in Hargeisa and Marine Products in Berbera—that manufacture fiberglass boats and wooden canoes and supply most of the local fishers.[44]

Detailed information on the fisheries of Somaliland is available in, "An Investment Guide to Somaliland Opportunities and Conditions 2013–2014."[45]

b Catch reconstructions undertaken by the Sea Around Us should be considered living documents. The estimates they make are under dynamic revision as new information becomes available. In this report, we use an estimate of catch shared with us by the Sea Around Us in February 2015. Those numbers have since been revised (slightly downward). The values currently available through their website are therefore somewhat different (e.g., a total of 62,700 mt in 2010 opposed to the 64,900 mt estimated by the version shared with us).

c FishStatJ software.

1.3 Puntland Region

The most economically significant catches in Puntland are finfish, shark, and lobster. Sea cucumber, clams, cuttlefish, and oysters are also targeted at lower levels.[46] While there are no recorded domestic industrial fisheries in the region, there are recent reports of trawlers being flagged to Puntland (see Chapter 2). The sector is therefore almost exclusively based on small-scale artisanal activities and some subsistence capture.[47, 48]

In 2010, there were approximately 3,136 artisanal vessels in Puntland.[49] Seven vessel types are commonly used in the region and the vessel types used in the Gulf of Aden coast and the Indian Ocean coast vary to suit the predominant fisheries and landing conditions. The majority of fishers (70%) do not own the boats they work on.[50] The most recent estimate of the number of fishers operating in Puntland is 6,500, with approximately one-third of those being part-time fishers.[51] Fishing activities occur in 90 settlements, villages, and towns along the coastline. Some of these settlements are active only during the lobster fishing season.[52]

Like most of Somalia, Puntland does not have designated landing facilities along its coastline. Minor onsite filleting is done by fishers and fish traders. A limited number of fish and fish products are also salted and dried (e.g., shark and ray meat) or smoked (tuna and kingfish). Major processing facilities appear to be available in three privately owned fish canneries (in Las Koreh, Candala, and Habo) on the north coast. They produce canned or dried tuna and canned or fried sardine products for domestic consumption and export.[53] The current status of the Candala and Habo canneries is unknown, but the Las Koreh site is operational.[54]

Cold storage facilities produce frozen fillets, whole fish, lobster tails, and cuttlefish. Reports from 2010 show some Puntland settlements had ice plants (in Las Koreh, Bosaso, Bargal, Ras Hafun, Bar Madobe, Bander Beyla, Durdura, Garad, and Dhinowda) and cold storage facilities (in Las Koreh, Bosaso, Habo, and Bargal). There were several publicly owned ice plants along the east coast and a few privately owned ice production facilities on the north coast. These facilities had chillrooms and some had longer-term deep freezers. In addition, there were over 100 heavy-duty refrigerated trucks and mobile reefer units which were used mainly in the lobster fishery.[55]

A thorough analysis of the fisheries of Puntland is available from Kulmiye[56] in 2010 and a more recent assessment was carried out by the FAO.[57]

1.4 South Central Somalia

Little published information is available on the current fishing activities undertaken in South Central Somalia. Recently, this area has been subjected to periods of violence and has been an Al-Shabaab stronghold, making fishery data collection difficult. Though the number of working vessels and fishers is unknown, the area is fairly developed and contains the two largest ports in the country: Kismayo and Mogadishu. Cold storage facilities are available and expanding.[58] The Ministry of Fisheries also provided refrigerated trucks to Ceel Ahmed and Brava to transport their fish to Mogadishu.[59] Some export products from other regions move through Mogadishu's international airport.[60] For example, canned tuna is transported from Puntland to Mogadishu. Also, shark meat is transported from the north of the country via Kismayo to Kenya.[61]

Fishers and traders there operate similarly to other regions of the country, selling fish off beaches and to nearby fish markets, including a relatively large market in Mogadishu.[62] Wholesalers and retailers of canned fish products are involved in the distribution and sale of fish in South Central Somali towns, particularly Mogadishu.[63] Fish demand in this part of the country often exceeds supply, especially in urban areas. As a direct consequence, canned fish products are frequently imported.[64]

2. FISHERIES VALUE CHAINS[d]

Value chains illustrate the flow of fish products from point of capture to end-customer to provide an appreciation of the nature of trade and utilization of fish products and of the revenue generated from wild-capture fish resources that are consumed in-country or exported to foreign markets. We identified the value chains for three key fish products: finfish, sharks, and lobster. To create value chains, the distribution pathways of fish and fish commodities from fisher to final in-country consumers or exporters were mapped using available information from the literature and from key contacts. Where possible, we have provided a qualitative description of the value added between the first and final point of sale within the value chain.

d Analysis completed by MRAG.

2.1 Finfish fishery

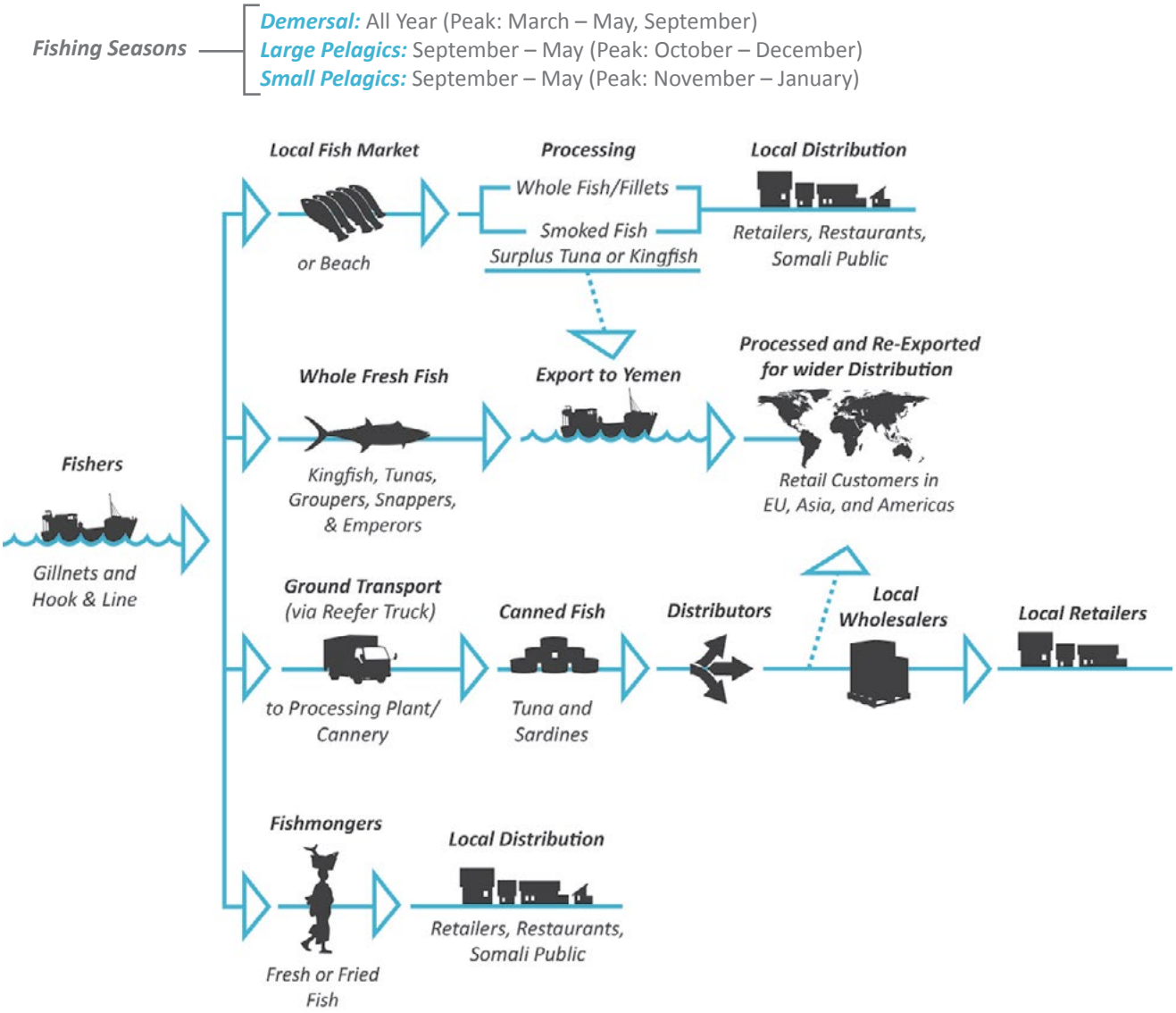
The finfish fishery in Somalia includes both large pelagic and demersal species from along the entire Somali coast (Figure 3.4).

Domestic market actors

Fishers (producers): Fishers participating in the finfish fishery throughout Somalia include: (1) fishers who do not own boats but embark as crew on Somali vessels; (2) boat owners who go to sea; and (3) independent fishers who operate on foot (mainly pastoralists, internally displaced persons, or local subsistence fishers).[65]

Boat owners (traders): Owners rarely join fishers on trips, but there are cases in which an owner is also a skipper. In such cases, owners get a share of profit from being a fisher (50% of the landings earnings) plus an owner's share (50% of profits). Boat owners are usually involved in the daily running of boats, including inputs required for fishing operations (fishing gear, ice, fuel, etc.). They are also responsible for the sale of the catch at the landing beach and splitting the proceeds among the crew members and the boat.[66] Boat owners undertake limited processing activities, though they may fillet many species as a means of value addition. In some instances, they smoke surplus tuna or kingfish if the fresh catch is not transported to the canneries or sold on the local market or to Yemeni boats.

FIGURE 3.4 Value chain for the finfish fishery.



Fishmongers: Women make up a significant proportion of this group. Fishmongers buy fish from fishers at the landing beach and then sell it to the public either fresh or fried. They also act as agents for other fish sellers and restaurant owners who give them a commission for every consignment of fish.

Fish canneries: This group has large potential in terms of domestic production and employment creation, but there are relatively few working canneries in Somalia. Fish (mainly tuna and sardines) are caught or purchased and transported to canneries for processing into dried tuna and canned or fried sardine products. However, due to supply constraints, most of these factories are not operating at full capacity and their profits are eroded by fixed overheads.[67] There is also strong competition from cheap imports, which sometimes forces canneries to sell their products at production cost in order to maintain their market share.[68]

Appointed distributors of canned fish: This group contains import and export companies who act as appointed distribution agents for the fish canneries. Products are distributed to wholesalers domestically or exported.

Wholesalers of canned fish: Wholesalers buy canned fish from the appointed distributors and then sell the product at wholesale to retailers in Bosaso and other large cities (e.g., Mogadishu).[69, 70, 71]

Retailers of canned fish: These actors are the owners of kiosks and other small shops in towns and villages across Somalia where canned fish and other products are sold. They form the last link of the marketing chain of the canned fish before public consumption.[72]

Export markets

The primary export market for finfish involves selling catches to Yemeni boats. Operators of the Yemeni boats are mostly Somali traders who operate through direct hire or profit-sharing agreements with the Yemeni owners.[73] The Yemeni boats mainly exchange goods (e.g., food, discounted fuel) for fish such as kingfish, tuna, grouper, snapper, and emperor. These boats buy and export to Yemen approximately 3,600 mt of fresh fish per month during the fishing season (29,000 mt per year).[74] This is an extremely important market for Somalia in terms of production, employment, and revenue generation due to the high demand from Yemen. Yemeni collection boats were considered a primary market for 42% of Puntland fishers and an important secondary market for 44% of all fishers.[75] Somali fishers are susceptible to price exploitation by Yemeni buyers due to the lack of alternative markets, supply coordination among Somali fishers, and cold chain infrastructure leading to low-quality fish (see also Chapter 2 Box 2.3).[76, 77]

2.2 Shark Fishery

Shark fisheries in Somalia occur along the north (Gulf of Aden) and east (Indian Ocean) coasts. Shark products (meat and fins) are a major export commodity (Figure 3.5).

Domestic market actors

Fishers: Shark fishing is a traditional activity that has been undertaken in Somali waters for centuries. Various species of sharks and rays are targeted by fishers for both fins and meat. Fishing methods include gillnets and longlines. Landed sharks are finned, beheaded, and gutted and the meat is then incised, washed with seawater, salted, and dried. Drying on the ground under unhygienic conditions can expose meat to pests, birds, and domestic animals. Proper drying of shark meat entails using drying racks, which are structures raised about one meter above the ground. Hafun, Bar Madobe, Bander Beyla, and Durdura have such structures, and shark products from those sites are reportedly of better quality than those from places without drying racks.[78] In Bosaso, structures with protective nets are also reportedly used to dry meat from sharks and rays.[79]

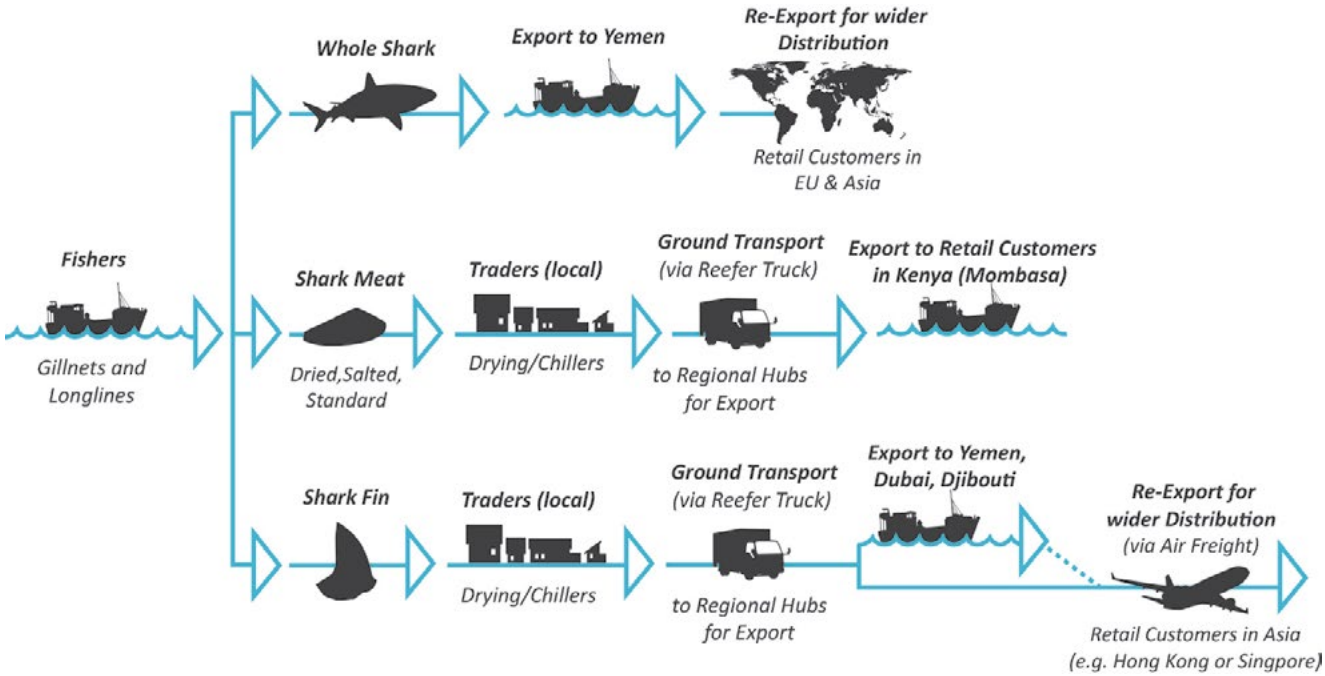
Local traders: These actors buy fins and dried shark meat from fishers to sell to businesspeople in Bosaso, who in turn export the fins and dried shark meat to the respective markets. Traders also perform an ancillary role for the domestic fishers by selling fishing gear and other inputs and thus provide a vital supply of goods to coastal villages. Fishers often obtain the inputs they need for their fishing operations from traders on credit with an agreement that they will sell their catches exclusively to the trader.[80]

Export markets

Shark fins are air-freighted to destinations in Asia such as Hong Kong and Singapore. In the past, fin exporters have also sold their products through intermediary traders in Dubai, but over the past 10 years Somali exporters have established direct business relationships which they supply under binding contracts. This has made the export of shark fins much easier and more profitable for exporters.[81]

FIGURE 3.5 Value chain for the shark fishery.

Fishing Season: May – September



Dried shark meat is transported by road to Kismayo and then by boat to Mombasa, the largest market for dried shark meat in East Africa. The dried shark meat has to pass through various roadblocks and security points. Traders frequently encounter problems with Kenyan import documentation, slowing legal importing of their products into Kenya.[82]

In the same way finfish products are exported via Yemeni boats, fishers who catch sharks as bycatch when fishing for large pelagic fish sell them whole (with fins attached) to the Yemeni boats.[83] These are exported to Yemen for processing and sale.

2.3 Lobster fishery

Lobsters exist along the length of the coastline of Somalia, but the largest catch is off Puntland. Frozen lobster tails are a major export commodity to the United Arab Emirates (UAE) and then on to other international markets (EU, Asia, and America) (Figure 3.6).

Domestic market actors

Fishers: Artisanal fishers use lobster nets (mono- and multifilament) set in shallow waters to capture lobsters. Wire traps are also used by fishers on foot and diving gear is used by artisanal fishers to catch lobsters. All catches are processed into tails, mostly by the fishers themselves, and then sold on to local traders.[104, 105]

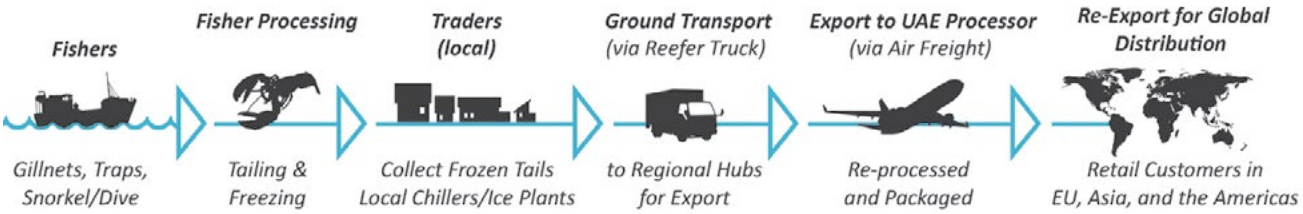
Local traders: Traders use reefer trucks to freeze and store the tails, which they transport by road to Garowe or Galkayo.[106, 107] The number of local traders involved in this business and the quantity of lobsters exported has decreased over the years owing to the dwindling lobster catches resulting from overfished stocks. In 2010, 11 lobster processing and exporting companies remained in Puntland, a dramatic decline from more than 100 companies in the 1990s.[108]

Export markets

From Garowe and Galkayo frozen tails are air-freighted to the UAE where they are reprocessed, packed, and re-exported to Asia, Europe, and America as a product of Oman.[109]

FIGURE 3.6 Value chain for the lobster fishery.

Fishing Season: October – April



3. VALUATION OF SOMALI DOMESTIC FISHERIES[e]

We estimate the current value of Somali domestic fisheries is approximately US$135 million each year. Here, we quantify this value by calculating the landed value (first point of sale) and the total value of the domestic fishing sector. The lack of robust national price and fishery product volume data for all stages of the value chains (illustrated above) constrains valuation, and a formal value chain analysis is not possible. We therefore take a conservative approach by applying a fishery-specific economic multiplier to our estimate of landed value.

3.1 Methods

Estimates for volume of fish landed by the domestic fishery were obtained from the Sea Around Us, and prices for that fish were acquired through publications, inquiries to experts familiar with the regional fisheries of the Gulf of Aden, Arabian Sea, and Indian Ocean, and surveys of Somalis involved in the fishing sector. As reconstructed by the Sea Around Us, the domestic fishing fleet includes small-scale fishers and industrial vessels. Small-scale fishing activities have been disaggregated into an artisanal fishery in which fish are sold by small-scale operators, and a subsistence fishery in which fish are caught for direct consumption or local barter. The industrial fleet is primarily composed of foreign vessels or vessels formerly under joint ventures, and it is unclear whether catch is landed in Somalia. If not, the value of this catch will not enter the Somali economy. Consequently, we analyze the industrial sector separately. See Appendix 5 for methodological details.

To estimate annual revenue, landings were multiplied by the price fishers received for a given category of fish.[f] Annual revenue was used as proxy for landed value. An economic multiplier, derived from analysis of artisanal fisheries in Africa,[110] was applied to the landed value to estimate total value at the end of the value chain.

Landings data

Landings come from estimates of reconstructed domestic catches by the Sea Around Us[111] that are used elsewhere in this report (§1 above and Chapter 4). Reconstructed catch includes reported catch, unreported catch, and discards. We exclude discards[g] from further analysis because they are not landed and sold, and we refer to reported and unreported catch as landings. The most comprehensive source of price data, fish exports reported to the FAO,[112] ended in 2009; therefore, and to work with a static estimate, we averaged landings over a five-year period (2005–2009) that overlapped FAO price data. Landings were combined into species groups (see Appendix 5 Table A5.1) and, where possible, associated commodities were identified (e.g., fresh/chilled/frozen, dried, salted, smoked, whole/fillet/minced, shark fins, lobster tails).

For sharks, three distinct products were identified: whole shark, shark meat, and shark fins. Shark fins are the most valuable product from sharks and value is based on the quality, color, and size. We assumed landed weight for fins was roughly 2% of total landed body weight,[113] and we assumed landings consist of approximately 12% white (higher quality) and 88% black (lower quality) fins.[114]

e Analysis completed by MRAG.

f The analysis is limited to assigning revenues (benefits) but not costs as a formal cost-benefit analysis was precluded by data unavailability.

g Discards make up a small percentage of total catch because unwanted bycatch is low in multi-species artisanal fisheries.

Box 3.2: Conservation of Sharks and Rays

Over the past few decades, global catch of sharks and rays has increased rapidly. Concurrently, their populations have experienced an alarming decline.[84, 85] Estimates of global shark mortality range from 63 million to over 273 million sharks killed by humans every year (or about 1.4 million mt on average).[86] The range in estimates stems largely from widespread underreporting of shark catch. One study[87] of the shark fin industry in 2000 showed reported catch was only one-fourth of actual catch. Underreporting is common because significant numbers of sharks and rays are discarded as unwanted bycatch, because many sharks are finned and then the bodies are dumped at sea, and because catch of sharks and rays is most common in small, artisanal fisheries that have fewer regulations and reporting requirements.[88]

In the Western Indian Ocean (WIO), sharks and rays make up only 1% of marine capture reported to the FAO (see Chapter 2), but actual catch may be significantly higher. In 2013, capture of 104,871 mt of sharks, rays, and chimeras in the WIO was reported to the FAO. Of this, 78% was reported as unspecified[h] sharks and rays, 8% was blue sharks, 5% was other requiem sharks (including reef sharks, lemon sharks, and tiger sharks), 2% each were milk sharks and silky sharks, and 1% was shortfin makos.

While there is significant uncertainty around harvest numbers, patterns of shark population decline have been replicated around the world.[89] Most species of sharks and rays have characteristics that make them vulnerable to overfishing: slow growth, long lives, and low birth rates.[90] Most shark populations cannot withstand high levels of fishing pressure before their populations begin to decline. Researchers estimate current levels of shark fishing mortality are much higher than populations can withstand,[91] and according to classification by the International Union for Conservation of Nature, 28% of all sharks[i] are at risk for extinction.[92]

The consequences of overfishing go well beyond population-level impacts on sharks and rays. In most systems, sharks are top predators and they play an incredibly important role in the food web. When sharks are removed from an ecosystem, other species of fish suffer as well.[93] These ecosystem spillover effects can have disastrous impacts on local fishing sectors, decreasing the economic viability and long-term sustainability of fisheries.

The global shark fin industry has an especially large negative effect on the health of shark populations.[94] Commonly, shark bodies are dumped back into the sea and only the fin is retained. This is problematic for a number of reasons: boats can hold many more fins than whole sharks, facilitating high rates of harvest; information on the size and species of sharks is often lost, compromising accurate reporting and data collection; and meat that otherwise would have been a viable product for human consumption is wasted. Likewise, rays are of increasing value because their gill rakers are used in traditional Chinese medicine. Rays used to be discarded as unwanted bycatch in Sri Lankan gillnet fisheries, but now targeted ray fisheries are increasingly driven by high prices and collapses of populations elsewhere (e.g., in Indonesia).[95]

The plight of sharks and rays in Somali waters is no different from that in the rest of the world. The Somali domestic fishery lands a significant amount: over 33% of estimated catch in Somali waters is sharks or rays (see main text §1.1). Additionally, many of the foreign fleets fishing in Somali waters catch sharks, either as directed fisheries or as bycatch. Sri Lankan longline vessels have targeted sharks off the Somali north coast.[96] The Iranian, Yemeni, and Pakistani gillnet fleets have very large amounts of shark bycatch associated with their fisheries.[97] IOTC-authorized vessels may target tuna, but they also catch sharks in longline and gillnet fisheries. While shark catches should be reported to the IOTC, there is widespread underreporting of shark catch by IOTC vessels.[98] Finally, Somali waters may

h FAO categories of *Sharks, rays, skates, etc. nei; Rays, stingrays, mantas nei;* and *Various sharks nei* aggregated. Nei stands for "not elsewhere included."

i For which sufficient data exist for analysis.

BOX 3.2 (CONT'D)

be a refuge for shark fishers who have been displaced from other waters due to declining populations or regulations meant to curb shark finning.[99] Our sustainability analysis (Chapter 4) shows sharks are fished at unsustainable levels in Somali waters. Altogether, reconstructions of foreign (Chapter 2) and domestic (Chapter 3) shark and ray catches are 26,000 mt each year in Somali waters.

Despite the precarious status of shark and ray populations, many scientists remain optimistic that conservation measures and effective management can rebuild these fisheries. Several steps can be taken to protect shark and ray populations so future sustainable fisheries are possible. These steps include:[100, 101, 102]

1. A reduction in the amount of catch of sharks and rays.
2. Protection of critical habitat for sharks and rays, such as spawning grounds.
3. Increased reporting of shark and ray catches, and reporting of what species are being caught, in both targeted and bycatch fisheries.
4. Increased import taxes on shark fins and other shark and ray products.
5. More stringent regulations on shark finning, including requirements to keep whole sharks on board until landing.
6. Local user rights to shark and ray catch allocations.

Shark and ray populations are facing a serious and potentially irreversible threat from uncontrolled levels of fishing pressure. Many experts fear widespread extinction is possible.[103] To avoid such a fate, and to protect the livelihoods of Somali fishers who depend on shark and ray fisheries, careful and immediate attention to shark and ray management is needed.

Price data

The availability of price data, and in particular price data at each stage of the value chain, was limited. Existing data also have quality concerns, such as representativeness of the variability between cities. We relied primarily on FAO commodity data, and supplemented with market prices for fish and fish commodities sourced from literature and local sources when needed (Table 3.1). To compensate for poor spatial coverage in prices, we analyzed the minimum, mean, and maximum prices. Prices were then multiplied by average landings (mt) to estimate the associated revenues at the first point of sale, or the landed value.[115]

We estimated values for the small-scale artisanal, small-scale subsistence, and industrial fishing sectors. While industrial fishing vessels likely land their fishery products outside the country, [116, 117, 118] we also estimated the value the industrial landings would have if sold through the domestic supply chain.

Landed value represents the direct economic value of the fisheries sector output,[119] but it also underestimates the economic importance of fisheries. Prices from farther along the value chain were not available, therefore an economic multiplier was used to account for the linkages throughout the sector. Economic multipliers provide a raising factor for the landed value to estimate the contribution to economic output of the next steps in the value chain, including activities directly and indirectly dependent on fish landings.[120, 121, 122] Dyck and Sumaila[123] calculated a multiplier for Somali fisheries (2.95) and an average multiplier for Africa (2.59). Given the uncertainty inherent in the price data we collected, market heterogeneity, and market volatility, we used the more conservative average figure.

3.2 Value of Landings at First Point of Sale for the Small-Scale Domestic Fleet

During 2005–2009, an average of 40,833 mt of fish were landed each year by the small-scale fleet: 32,310 mt from

the artisanal sector and 8,523 mt from the subsistence sector. We estimate that the annual landed value for the artisanal and subsistence sectors was between US$23.8 and US$104.2 million (average US$58.3 million, Table 3.2). To this, the artisanal sector contributed between US$20.4 and US$84.5 million annually and the subsistence sector contributed between US$3.4 and US$19.7 million (Appendix 5).

TABLE 3.1 Prices for fishery commodities in the Somali domestic fishing sector.

Fishery Group	Price Range (US $/kg)	Source*
Billfish	0.40–2.00	16, 28
Clupeids	0.20–2.30	16, 128, 131
Common Dolphinfish	0.98–0.98	130
Cuttlefish	0.25–3.00	131
Groupers	0.25–2.50	16, 28, 127, 128, 131
Goatfish	0.30–2.30	114, 129, 131
Jacks and Scads	0.15–2.30	129, 131
Rays and Mantas	1.50–1.50	129
Sharks (meat)	0.20–2.50	16, 28
Sharks (fins)	95.00–120.00	10, 16, 128, 129
Snappers	0.20–2.50	16, 28, 128, 129, 131
Yellowfin tuna	0.80–4.00	16, 28, 129, 131
All other tuna	0.40–3.00	16, 28, 128, 131
Emperors	0.50–2.30	16, 128, 129, 131
Spiny lobster	5.00–20.57	16, 28, 114, 127, 128, 131
Mackerel	1.00–5.00	28, 128, 129, 131
Miscellaneous marine fish	0.98–0.98	114

*Source numbers refer to the respective corresponding number listed in the references section at the end of the chapter

TABLE 3.2 Economic value of Somali fisheries. Industrial catches are primarily landed outside Somalia and therefore value does not enter the Somali economy.

Fleet	Average landed value (US$)	Value chain multiplier	Total value to Somali economy
Artisanal	$48,500,000	2.59	$125,500,000
Subsistence	$9,900,000	1.00	$9,900,000
Industrial	$20,500,000	Not applicable	None
Total	$78,900,000	-	$135,400,000

The artisanal fleet landed primarily sharks (9,153 mt per year) and other elasmobranchs (miscellaneous rays and mantas, 3,470 mt per year), tunas (yellowfin and other tuna, both 5,454 mt per year) and emperors (3,636 mt per year). This is consistent with other reports on catch composition.[124, 125] Annual landed values for these commodities were: sharks, meat US$11.6 million, plus fins US$2.4 million; yellowfin tuna, US$6.5 million; and rays and mantas, US$5.2 million. Emperors, other tunas, and spiny lobsters were also valuable commodities (Figure 3.7). Spiny lobsters are particularly valuable relative to their landed weight.

Subsistence landings included emperors (3,423 mt per year), miscellaneous jacks and scads (856 mt per year), clupeids (856 mt per year), and groupers (856 mt per year). While subsistence fishers primarily consume, give away, or barter their fish, and therefore this landed value does not necessarily equate to formal income, the landed value averaged US$9.9 million each year (Figure 3.7).

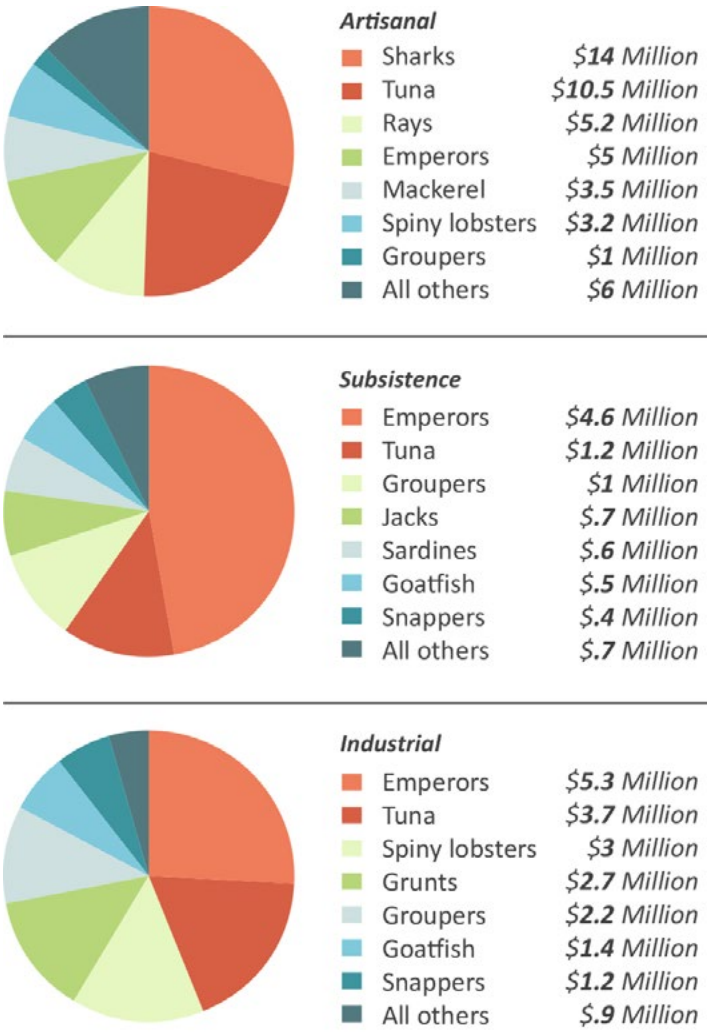
3.3 Value Added Through the Domestic Supply Chain

We estimated the total economic value of the artisanal sector by applying a multiplier (2.59)[126] to the estimate of landed value. The total economic value of the small-scale artisanal fishery ranged from between US$56.3 and US$238.6 million (average US$125.5 million, Table 3.2).

3.4 Value of Landings at First Point of Sale for the Industrial Fleet

Most catch by Somali industrial vessels is landed outside of Somalia so the value goes elsewhere. We include here these values for reference, but it is likely that they do not contribute to the Somali economy. Using the prices calculated here, the landed value of fish caught by industrial vessels ranged from between US$6.9 million to US$39.7 million (average US$20.5 million, Table 3.2). Licensing foreign vessels could bring in, at most, about 10% of the landed value, so landing the catch from these vessels in Somalia would be a significantly greater retention of revenue. However, realizing the additional benefits from

FIGURE 3.7 Landed value of fish commodities from the Somali artisanal, subsistence, and industrial fishing sectors.



landing in-country would require additional investment in fleet, port, and transport infrastructure (see Chapter 4 Box 4.1).

The industrial fleet landed emperors (3,925 mt per year), painted sweetlips (2,626 mt per year), groupers (1,796 mt per year), and snappers (1,409 mt per year), while sharks were not reported. Tuna also were important (yellowfin, 1,064 mt per year; as well as other tunas, 815 mt per year). Valuable species included emperors (US$5.3 million per year), tunas (US$3.7 million per year), spiny lobsters (US$3 million per year), and painted sweetlips (US$2.7 million per year) (Figure 3.7).

4. CONCLUSIONS

Currently, the total economic value of the Somali domestic sector is estimated between US$56 and US$239 million. This value is dominated by the contribution of the Somali artisanal sector (Table 3.2). However, substantially greater economic benefit could be obtained by the Somali fishing and seafood industries through value addition to fisheries commodities throughout the domestic supply chain. Many of the vessels in the domestic small-scale fleet have limited range and lack ability to fish during poor weather. This limits the potential catch and also restricts the length of the fishing season. Landing sites are not equipped with sufficient support services (gear, ice, transport and safety equipment) or infrastructure for chilling, storing, and transporting fish. As a result, Somali fishers cannot leverage price premiums that accrue to processed fish. Developing small-scale facilities could enable fishers to add value to catches and provide a means to improve marketing opportunities. Greater marketing of traditionally discarded fish could lead to less reliance on vulnerable species such as shark.

Somalia's low per capita fish consumption suggests strong potential for development of the domestic market. Currently, fish marketing is patchy and the main markets are limited to urbanized areas. Furthermore, strong demand for seafood in markets beyond the Middle East could provide additional opportunities for adding value through exports. However, realizing this potential requires overcoming a number of practical constraints to marketing. In the first instance, domestic marketing is constrained by a lack of infrastructure for handling and transporting fish products, especially outside the main centers of population. This means that the majority of fish sold is salted or smoked rather than fresh chilled because of the lack of ice and refrigeration. Local trade is generally ad hoc with traders selling fish where they can. Exporting is reliant on intermediaries and Middle East markets that are currently vulnerable due to unrest. The export trade would benefit from diversification, but this is hampered by the lack of infrastructure and the need to meet destination market requirements such as meeting food safety and traceability standards. While there are challenges to overcome for developing the Somali fishing economy, there is significant potential for it to contribute greatly to economic and food security for a large portion of the Somali population.

REFERENCES

1 Food and Agriculture Organization of the United Nations. (2014). *The State of the World Fisheries and Aquaculture 2014*. Rome. Retrieved from http://www.fao.org/3/a-i3720e.pdf

2 de Graaf, G. & Garibaldi, L. (2014). *The value of African fisheries*. FAO Fisheries and Aquaculture Circular. No. 1093. Rome: FAO. 76 pp. Retrieved from http://www.fao.org/3/a-i3917e.pdf

3 Béné, C. (2009). Are Fishers Poor or Vulnerable? Assessing Economic Vulnerability in Small-Scale Fishing Communities. *Journal of Development Studies*, 45(6), 911–933. doi:10.1080/00220380902807395

4 McClanahan, T., Allison, E. H., & Cinner, J. E. (2013). Managing fisheries for human and food security. *Fish Fish*, 16(1), 78–103. doi:10.1111/faf.12045

5 Béné, C., Phillips, M., & Allison, E. H. (2011). The Forgotten Service. In *Treatise on Estuarine and Coastal Science*. (eds Wolanski, E. and McLusky, D.S.). Academic Press, Waltham, MA, pp. 147–180. doi:10.1016/b978-0-12-374711-2.01208-0

6 Cochrane, K. L. (2000). Reconciling sustainability, economic efficiency and equity in fisheries: the one that got away? *Fish and Fisheries*, 1(1), 3–21. doi:10.1046/j.1467-2979.2000.00003.x

7 Lovatelli, A. (1996). *Artisanal Fisheries Final Report*. European Commission Rehabilitation Programme for Somalia. Nairobi, Kenya.

8 Agulhas and Somali Current Large Marine Ecosystems Project. (2010). *Coastal Livelihoods in the Republic of Somalia*. Retrieved from http://www.dlist.org/sites/default/files/doclib/Somalia%20Annex%20XI%20CLA%20final%20draft%2022-11-2010.pdf

9 Lovatelli, *Artisanal Fisheries*

10 Food and Agriculture Organization of the United Nations. (2005). Fishery Country Profile: Somalia. Retrieved from http://www.fao.org/fi/oldsite/FCP/en/som/profile.htm

11 Ibid.

12 Hadley, S., & Sharmarke, F. (2014). *Somalia Economic Growth Strategic Assessment: Final Assessment Report*. United States Agency for International Development. Washington, DC. Retrieved from http://pdf.usaid.gov/pdf_docs/PA00JXG7.pdf

13 Food and Agriculture Organization of the United Nations, Fishery Country Profile

14 African Development Solutions. (2015). Illegal Unreported and Unregulated (IUU) Fishing in the Territorial Waters of Somalia. Nairobi, Kenya.

15 Fielding, P. J. & Mann, B. Q. (1999). *The Somalia Inshore Lobster Resource: A survey of the lobster fishery of the north eastern region (Puntland) between Foar and Eyl during November 1998*. Nairobi, Kenya: IUCN EARO. Retrieved from https://portals.iucn.org/library/efiles/documents/1999-088.pdf

16 Kulmiye, A. (2010). *Assessment of the status of the artisanal fisheries in Puntland through value chain analysis*. VSF Suisse and UNDP. http://shuraako.org/sites/default/files/documents/Assessment%20of%20the%20Status%20of%20the%20Artisanal%20Fisheries%20in%20Puntland%20Through%20Value%20Chain%20Analysis.pdf

17 Gulaid, A. (2004). Feasibility report on the fisheries sector in Somaliland: Current status, opportunities and constraints. Retrieved from https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&cad=rja&uact=8&ved=0CB4QFjAAahUKEwiixJSNjLHHAhWKGZIKHSxiCqg&url=http%3A%2F%2Fwww.somalilandlaw.com%2Fsl_fisheries_feasibility_report.pdf&ei=lVbSVeKlCIqzyASsxKnACg&usg=AFQjCNHk8MT1eSD51_ZyS-si-l5anAwKzfg&sig2=OUNY0pUyzSKrmhha9NODlg&bvm=bv.99804247,d.aWw

18 Government of Somaliland Ministry of Trade and Investment. (2014). *An Investment Guide to Somaliland Opportunities and Conditions 2013–2014*. Retrieved from http://somalilandinvest.net/somaliland_investment_guide.pdf

19 Somalia: Fishermen in Puntland quit Job due to 'threats' from Foreign Vessels, (2014, March 23). *Horseed Media*. Retrieved from http://horseedmedia.net/2014/03/23/somalia-fishermen-puntland-quit-job-due-threats-foreign-vessels/

20 African Development Solutions. (2015). Illegal Unreported and Unregulated (IUU) Fishing in the Territorial Waters of Somalia. Nairobi, Kenya.

21 Gulaid, Feasibility report

22 MacAlister Elliot and Partners Ltd. (2006). CARE Somalia: Tsunami livelihoods restoration and strengthening project. Report: 1909/R/01/C.

23 Agulhas and Somali Current Large Marine Ecosystems Project, *Coastal Livelihoods*

24 Kulmiye, *Assessment of the status*

25 Ibid.

26 Agulhas and Somali Current Large Marine Ecosystems Project, *Coastal Livelihoods*

27 Gulaid, Feasibility report

28 Mohamed, M. M., & Herzi, M. H. (2005). *Feasibility report on the fisheries sector in Puntland*. United Nations Development Programme Somalia. Retrieved from https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=2&cad=rja&uact=8&ved=0CCUQFjABahUKEwjjitWW5bDHAhXBEJIKHV3-ACM&url=http%3A%2F%2Fwww.somalilandlaw.com%2Fsl_fisheries_feasibility_report.pdf&ei=xC3SVeOYBcGhyATd_IOYAg&usg=AFQjCNHk8MT1eSD51_ZyS-si-l5anAwKzfg&sig2=NBkj8BWszyxLOHDqF6UOTg&bvm=bv.99804247,d.aWw

29 Agulhas and Somali Current Large Marine Ecosystems Project, *Coastal Livelihoods*

30 Food Security and Nutrition Analysis Unit, Somalia. (2011). Somali Knowledge Attitude & Practices Study (KAPS): Fish Consumption in Somalia. Retrieved from https://www.google.co.uk/url?sa=t&source=web&rct=j&url=http://www.fsnau.org/downloads/KAP-Study-Fish-Consumption-in-Somalia.pdf&ved=0CBwQFjAAahUKEwjxweX85rDHAhWBiQ0KHU-0EBws&usg=AFQjCNHiws_5YsohxJELep2ezT436XLuHQ&sig2=lsaheJXo_wOawKdZqZUmaw

31 Food and Agriculture Organization of the United Nations. (2014). A rapid analysis of the fisher folk registration data in Puntland State of Somalia (No. OSRO/SOM/303/CPF). Retrieved from http://www.fao.org/documents/card/en/c/78717f4e-e2f8-422a-a2fd-532da49b8b6f/

32 Government of Somaliland Ministry of Trade and Investment, *An Investment Guide to Somaliland*

33 Persson, L., Lindop, A., Harper, S., Zylich, K. & Zeller, D. (2015). Failed state: reconstruction of domestic fisheries catches in Somalia 1950– 2010. Pp. 111–127. In F. Le Manach and D. Pauly (Eds.) *Fisheries catch reconstructions in the Western Indian Ocean, 1950–2010*. Fisheries Centre Research Reports 23(2). Fisheries Centre, University of British Columbia [ISSN 1198–6727].

34 Gulaid, Feasibility report

35 Mohamend & Herzi, *Feasibility report*

36 Sabriye A (2005) Feasibility report on the fisheries sector in South and Central Somalia. Current status, opportunities and constraints., United Nations Development Programme, poverty reduction and economic recovery. Discussion paper, April 2005,. 36 p.

37 Persson et al., Failed state

38 Ibid.

39 Government of Somaliland Ministry of Trade and Investment, *An Investment Guide to Somaliland*

40 Gulaid, Feasibility report

41 Government of Somaliland Ministry of Trade and Investment, *An Investment Guide to Somaliland*

42 Ibid.

43 Gulaid, Feasibility report

44 Ibid.

45 Government of Somaliland Ministry of Trade and Investment, *An Investment Guide to Somaliland*

46 Kulmiye, *Assessment of the status*

47 Mohamend & Herzi, *Feasibility report*

48 Kulmiye, *Assessment of the status*

49 Ibid.

50 Food and Agriculture Organization of the United Nations, A rapid analysis

51 Ibid.

52 Kulmiye, *Assessment of the status*

53 Ibid.

54 Food and Agriculture Organization of the United Nations, A rapid analysis

55 Kulmiye, *Assessment of the status*

56 Ibid.

57 Food and Agriculture Organization of the United Nations, A rapid analysis

58 Hadley & Sharmarke, *Somalia Economic Growth*

59 Food and Agriculture Organization of the United Nations, Fishery Country Profile

60 Lovatelli, *Artisanal Fisheries*

61 Kulmiye, *Assessment of the status*

62 Lovatelli, *Artisanal Fisheries*

63 Food Security and Nutrition Analysis Unit, Somalia, Somali Knowledge

64 Kulmiye, *Assessment of the status*

65 Ibid.

66 Ibid.

67 Ibid.

68 Ibid.

69 Ibid.

70 Agulhas and Somali Current Large Marine Ecosystems Project, *Coastal Livelihoods*

71 Food Security and Nutrition Analysis Unit, Somalia, Somali Knowledge

72 Kulmiye, *Assessment of the status*

73 Ibid.

74 Ibid.

75 Food and Agriculture Organization of the United Nations, Fishery Country Profile

76 Kulmiye, *Assessment of the status*

77 Mohamend & Herzi, *Feasibility report*

78 Kulmiye, *Assessment of the status*

79 Personal communication, don't know who

80 Kulmiye, *Assessment of the status*

81 Ibid.

82 Ibid.

83 Ibid.

84 Worm, B., Davis, B., Kettemer, L., Ward-Paige, C. A., Chapman, D., Heithaus, M. R., …Gruber, S. H. (2013). Global catches, exploitation rates, and rebuilding options for sharks. *Marine Policy*, 40, 194–204. doi:10.1016/j.marpol.2012.12.034

85 Dulvy, N. K., Baum, J.K., Clarke, S., Compagno, L.J.V., Cortés, E., Domingo, A., …Valenti, S. (2005). You can swim but you can't hide: the global status and conservation of oceanic pelagic sharks and rays. *Aquatic Conservation: Marine and Freshwater Ecosystems,* 18: 459–482. doi:10.1002/aqc.975

86 Worm et al., Global catches

87 Clarke, S. C., McAllister, M. K., Milner-Gulland, E. J., Kirkwood, G. P., Michielsens, C. G. J., Agnew, D. J., …Shivji, M. S. (2006). Global estimates of shark catches using trade records from commercial markets. *Ecology Letters*, 9(10), 1115–1126. doi:10.1111/j.1461-0248.2006.00968.x

88 Barker, M. J., & Schluessel, V. (2005). Managing global shark fisheries: suggestions for prioritizing management strategies. *Aquatic Conservation: Marine and Freshwater Ecosystems*, 15(4), 325–347. doi:10.1002/aqc.660

89 Worm et al., Global catches

90 Dulvy et al., You can swim

91 Worm et al., Global catches

92 Ibid.

93 Jackson, J. B. C., Kirby, M.X., Berger, W.H., Bjorndal, K.A., Botsford, L.W., Bourque, B.J., …Warner, R.R. (2001). Historical Overfishing and the Recent Collapse of Coastal Ecosystems. *Science*, 293(5530), 629–637. doi:10.1126/science.1059199

94 Clarke et al., Global estimates of shark catches

95 MRAG. (2012). *A review of bycatch in the Indian Ocean gillnet tuna fleet focusing on India and Sri Lanka*. Washington, D.C.: International Seafood Sustainability Foundation. Retrieved from http://iss-foundation.org/wp-content/uploads/downloads/2012/05/ISSF-2012-05-IO-Gillnet-Bycatch.pdf

96 Jennings, T.M. (1998). Marine living resource governance in the absence of a central authority: A study of Somalia (Master's thesis). University of Washington, Seattle, Washington.

97 MRAG, *A review of bycatch*

98 Ibid.

99 Worm, B. & Branch, T.A. (2012). The future of fish. *Trends in Ecology and Evolution*, 27(11): 594–599. http://dx.doi.org/10.1016/j.tree.2012.07.005

100 Worm et al., Global catches

101 Barker, M. J. & Schluessel, V. Managing global shark fisheries

102 Dulvy et al., You can swim

103 Worm et al., Global catches, exploitation rates

104 Fielding & Mann, *The Somalia Inshore Lobster*

105 Kulmiye, *Assessment of the status*

106 Fielding & Mann, *The Somalia Inshore Lobster*

107 Kulmiye, *Assessment of the status*

108 Ibid.

109 Ibid.

110 Dyck, A. J., & Sumaila, U. R. (2010). Economic impact of ocean fish populations in the global fishery. *Journal of Bioeconomics*, 12(3), 227–243. doi:10.1007/s10818-010-9088-3

111 Persson et al., 2015

112 FAO Fisheries and Aquaculture Information and Statistics Service 2009. Fisheries commodities production and trade 1976-2009. FISHSTAT Plus - Universal software for fishery statistical time series. Food and Agriculture Organization of the United Nations. Available at: http://www.fao.org/fishery/statistics/software/fishstat/en Accessed: 05 February 2015

113 Biery, L., & Pauly, D. (2012). A global review of species-specific shark-fin-to-body-mass ratios and relevant legislation. *Journal of Fish Biology*, 80(5), 1643–1677. doi:10.1111/j.1095-8649.2011.03215.x

114 Ministry of Planning and Statistics. (2003). Puntland Facts and Figures. Retrieved from http://siteresources.worldbank.org/SOMALIAEXTN/Resources/PuntlandFigures.pdf

115 Sumaila, U. R., Marsden, A. D., Watson, R., & Pauly, D. (2007). A Global Ex-vessel Fish Price Database: Construction and Applications. *Journal of Bioeconomics*, 9(1), 39–51. doi:10.1007/s10818-007-9015-4

116 Gulaid, Feasibility report

117 Food and Agriculture Organization of the United Nations, Fishery Country Profile

118 Agulhas and Somali Current Large Marine Ecosystems Project, *Coastal Livelihoods*

119 Dyck & Sumaila, Economic impact

120 McIntyre, A. D. (1995). The Icelandic fisheries: Evo-

lution and management of a fishing industry. *Fisheries Research*, 24(3), 267–268. doi:10.1016/0165-7836(95)90018-7

121 Dyck & Sumaila, Economic impact

122 Teh, L. S. L., Teh, L. C. L., & Sumaila, U. R. (2011). Quantifying the overlooked socio-economic contribution of small-scale fisheries in Sabah, Malaysia. *Fisheries Research*, 110(3), 450–458. doi:10.1016/j.fishres.2011.06.001

123 Dyck & Sumaila, Economic impact

124 Vannuccini, S. (1999). Shark Utilization, Marketing and Trade. FAO Fisheries Technical Paper 389, Food and Agriculture Organization of the United Nations: Rome, Italy.

125 MacAlister Elliot and Partners Ltd, CARE Somalia

126 Dyck & Sumaila, Economic impact

CHAPTER 4. SUSTAINABILITY OF FISHING IN SOMALI WATERS

1. THE IMPORTANCE OF SUSTAINABLE FISHERIES

For almost two decades, fisheries scientists, marine ecologists, and conservation NGOs have been sounding the alarm about the state of global fisheries. A stagnation, and then decline, in global catch starting in the late 1980s suggested demand for fish was beginning to outstrip supply.[1] In the 1950s almost 80% of all fisheries were undeveloped; today, only 3% are undeveloped.[2] The number of collapsed and overexploited fisheries has grown to over half of all stocks in the world today, and most remaining stocks are fully exploited.[3] Unsustainable levels of fishing have important consequences for marine ecosystems: biodiversity is reduced,[4] fish populations decline,[5] and extinctions are more likely.[6] Unsustainable fisheries also negatively impact the human populations who depend on them. As the costs associated with fishing grow, coastal fishing communities, especially those in developing nations, are receiving fewer of the direct benefits of their marine resources.[7]

In the case of Somali fisheries, long-term sustainability is a critical goal shared by government, fishers, and coastal communities. It is embodied in the new Somali Fisheries Law through mandates of improved monitoring, ecosystem-based approaches to management, protection of threatened and endangered species, and total allowable catches based on optimum sustainable yield. But sustainability cannot be achieved through legislative tools alone. Our analysis (Chapter 2) shows foreign fleets harvest significantly more fish than Somalis do. Most of the vessels in foreign fleets are bigger, faster, and more technologically advanced than Somali vessels. Consequently, in the race to fish that ensues when resources decline, foreign vessels will have the competitive edge. Around the world, industrial distant water fishing fleets are crowding out small-scale and artisanal fishers. Small-scale fishers are some of the poorest in the world and are extremely vulnerable to changes in resource status.[8] Sustainable harvest of resources is therefore a safeguard against economic shocks and loss of income for Somali fishers.

Here, we analyze the potential for fishing in Somali waters at sustainable levels and whether current fishing levels achieve sustainability. As noted before, the analyses possible are constrained by the amount (e.g., duration and resolution) and quality of data available. Data-poor approaches to sustainability analysis have been developed in recent years and promise to advance our understanding of under-monitored fisheries. But they carry with them important caveats and cautions. To the best of our ability we offer here a baseline estimate of fishery potential and sustainability of fisheries in Somali waters. Somali fishery scientists and authorities, international actors, and NGOs should capitalize on this beginning to improve estimates and further our understanding of the health of Somali fisheries.

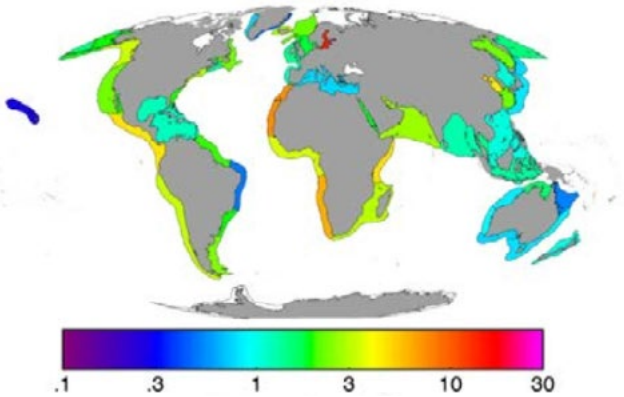
2. FISHERY PRODUCTION POTENTIAL IN SOMALI WATERS

Somali waters are known for supporting high biomass of marine life (see Chapter 1 §3). The fishery production potential (FPP) of an area refers to the total biomass (in metric tons) of marine life that could be extracted on an annual basis when both economic (e.g., demand and feasibility) and ecological (e.g., food web links and sustainability) considerations are made. A recent FAO assessment[9] of global FPP ranks Somali waters among the world's highest (Figure 4.1). The Somali Coastal Current Large Marine Ecosystem (LME),[a] along the Somali

a Large Marine Ecosystems are contiguous areas of the coastal ocean that have similar physical and biological characteristics, often defined by water masses or currents and biological populations. See http://lme.edc.uri.edu

east coast, is ranked fourth in the world in FPP.[b] Out of 54 ranked LMEs, only the Baltic Sea, Canary Current (African northwest coast), and Benguela Current (African southwest coast) could sustainably produce more fish per square kilometer. Likewise, the Arabian Sea LME, along the Somali north coast, is ranked eighth in the world. This makes Somali waters potentially more productive, per unit area, than some of the largest fishing regions in the world, such as the California Current LME (U.S.) or the Humboldt Current LME (Chile/Peru).

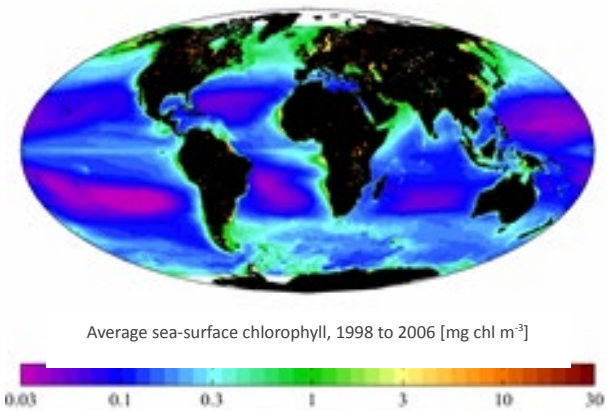
FIGURE 4.1 Example of fishery production potential (FPP) estimated for top predators (i.e., piscivores like tuna) in 53 Large Marine Ecosystems around the world. Reproduced from Rosenberg et al. 2014.[10] Color bar is in units of tons per km^2.



A scientifically rigorous estimate of the amount of fish that could be sustainably harvested each year from Somali waters is sorely needed. Somali Fisheries Law mandates regulation of fishing to produce optimum sustainable yield (OSY), and catch can only be allocated to foreign vessels if surplus resources are available after domestic allocation. Estimates of fishery potential can be used to understand how much fishing the ecosystem can tolerate, what levels of fishing correspond to OSY, and how much surplus resource is available to foreign vessels. A best-practices approach to estimating fishery production potential would involve robust estimates of energy in the system (annual primary productivity derived from chlorophyll estimates, see Figure 4.2), quantifying how that energy moves through the Somali marine ecosystem, and having clear estimates of the amount of fishing pressure the system experiences.

b This refers to the amount of fish that could be caught, not the amount that is currently being caught.

FIGURE 4.2 Global estimates of sea surface chlorophyll (averaged from 1998 – 2006) derived from satellites as an example of data used to estimate fishery production potential. Image from Wikipedia.



Several historical estimates of potential fish catch in Somali waters exist. However, our review of their origins leaves us hesitant about their rigor and comparability. Estimates range from 180,000 metric tons (mt) per year[11] to over 680,000 mt per year,[12] leaving ample room for misjudgment over the degree of fishing that can be sustainably conducted. In his 1981 thesis,[13] Yassin aggregated data published in other reports with surveys conducted by the *R/V Fridtjof Nansen*[14] to estimate an annual catch potential of 680,000 mt. In 1983, Haakonsen[15] reported annual catch potential of 180,400 mt for large and small pelagic fishes, demersal fishes, sharks and rays, lobster, and shrimp. The methods and data by which this estimate was derived were not reported. In a 1999 conference paper, Hassan and Tako[16] report an FAO estimate of 300,000 mt of fish catch possible per year, but they do not reference the original source (or method by which it was derived).

We mention these estimates because they have been used in the past to inform the discussion of fishery potential in Somali waters. However, in the past year a new global FPP model (introduced above) has been built. A version of the model and its results exist in Rosenberg et al. published in 2014.[17] The model is undergoing regular revision, and we obtained more recent estimates of FPP directly from the authors.[18]

Briefly, the model divides the world into Large Marine Ecosystems[19] and estimates primary production from satellite images of ocean color in each LME. Primary

production measures the amount of energy being created by photosynthesis by phytoplankton (see Figure 4.2). A food web model traces the flow of energy between prey and predators in each LME. The model measures FPP by estimating the biomass in different parts of the food web and applying constraints that account for the viability of a fishery for a given type of fish (e.g., whether it is a desired food source and whether harvest is economically practical). FPP is calculated as the amount of fish that could be sustainably harvested, assuming harvest should not exceed 20%–25% of available production. To simplify the model and data requirements, species of marine life were aggregated into categories of piscivores (animals that consume fish and are generally considered top predators, such as tuna), planktivores (animals that consume plankton and are consumed by predators, such as sardines), and benthivores (animals that consume bottom-dwelling organisms, such as flatfishes). Please see the original FAO document for full methodological details.[20]

We were provided with the most recent model estimates of FPP for piscivores, planktivores, and benthivores for the Somali Current LME and Arabian Sea LME (Table 4.1 and Figure 4.1). The LMEs are much larger than the area defined by the Somali Exclusive Economic Zone (EEZ), so to estimate FPP of the Somali EEZ, we calculated the overlap between the two LMEs and the EEZ (see Appendix 6). Northern Somali waters encompass 5.3% of the Arabian Sea LME, while eastern and southern Somali waters encompass 55.4% of the Somali Current LME. The FPP estimated for the full LME area was then reduced (weighted) by the percent of areal overlap (Table 4.1, area-weighted FPP columns). Finally, we combined FPP in the two LMEs that overlapped Somali waters. Fish catch in Somali waters by the foreign fleets (Chapter 2) and fish catch from the Somali domestic fleet (Chapter 3) were aggregated into categories of piscivores, planktivores, or benthivores (Figure 4.3) and compared to the total FPP in Somali waters (Table 4.1).

Somali waters have a FPP of 835,000 mt per year (Table 4.1). By comparison, we estimate only 194,000 mt of fish were caught in Somali waters in 2013. However, the harvest of these fish is severely unbalanced with respect to categories of fish. The FAO model estimates Somali waters can sustainably produce 136,000 mt of piscivores each year. This category includes tuna, billfishes, sharks, and predatory coastal fishes such as snappers. In 2013, we estimate 139,000 mt of piscivores were harvested from Somali waters. Consequently, this category of fishes appears to be fished at maximum capacity. We conclude fishing fleets in Somali waters cannot increase the amount of piscivores caught without implicating the sustainability of these commercially valuable fisheries.

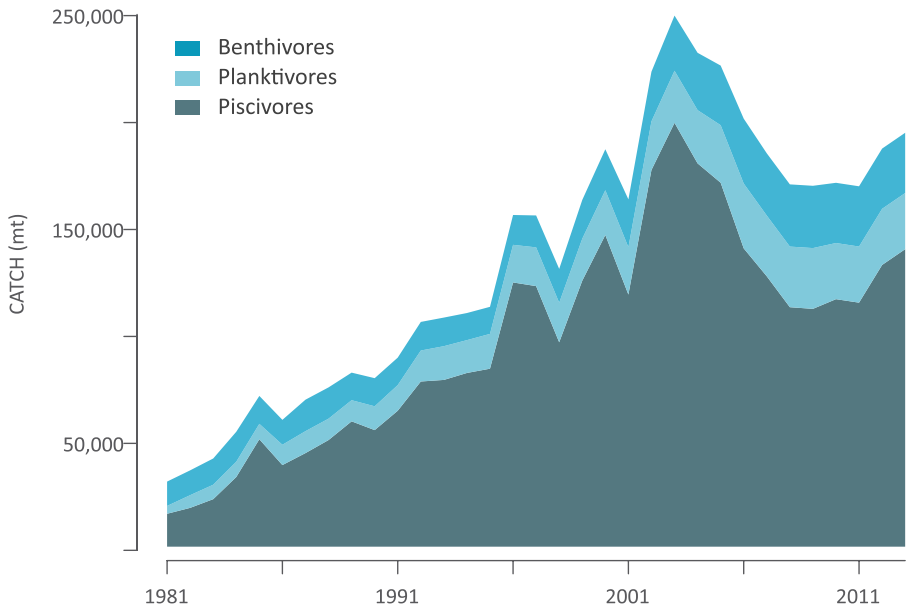
On the other hand, planktivores (such as sardines) and benthivores (such as flatfishes) are fished far less than their estimated FPP (Table 4.1); 335,000 mt of planktivores could be harvested from Somali waters each year but only 26,000 mt were harvested in 2013. Likewise, 364,000 mt of benthivores could be harvested from Somali waters each year but only 28,000 mt were harvested. In order to protect the long-term sustainability of Somali's fisheries, development of fisheries for planktivores and benthivores may be most profitable and ecologically sound (but see §3 below in which specific families of benthivores, such as emperors, are classified as unsustainable).

It is extremely important to note that the total FPP estimated for Somali waters, 835,000 mt per year, is only achievable if significant increases in catch are made for benthivores and planktivores. A significant amount of the planktivore biomass is composed of small mesopelagic

TABLE 4.1 Fishery production potential (FPP) compared to current catch in Somali waters. Catch is from foreign and domestic fishing combined. The area-weighted FPP columns give estimates of FPP in the LMEs that overlap Somali waters as defined by the Somali EEZ. All units are mt.

Fishery Category	FPP in Somali LME	FPP in Arabian Sea LME	Area-Weighted FPP, Somali LME	Area-Weighted FPP, Arabian Sea LME	Total FPP in Somali Waters	Total Catch in Somali Waters (2013)
Piscivores	215,000	323,000	119,000	17,000	136,000	139,000
Planktivores	542,000	646,000	301,000	34,000	335,000	26,000
Benthivores	597,000	633,000	331,000	33,000	364,000	28,000
Total	**1,354,000**	**1,603,000**	**751,000**	**84,000**	**835,000**	**194,000**

FIGURE 4.3 Fisheries catch (foreign and domestic) in Somali waters.



fishes (myctophids or lanternfishes) that are not currently harvested at meaningful scales. Myctophids are not likely to be sold for direct human consumption, but they could contribute to fishmeal production in the future. The large imbalance in harvest between piscivores on the one hand and planktivores and benthivores on the other hand is illustrative of a global pattern: top predators have been highly desired for human consumption for many decades and their harvest levels are likely at (or in excess of) levels that are sustainable. For humans to increase fish catch in a sustainable manner, a more balanced approach to harvesting should increase catch of benthivores and planktivores. In this regard, Somali waters are no different than those in the rest of the world's oceans.

3. SUSTAINABILITY OF FISHERIES AT CURRENT LEVELS OF FISHING EFFORT

The FPP analysis compares potential to actual harvest at highly aggregated taxonomic scales. But for a fuller understanding of the status of Somali fish stocks, sustainability analysis should be done for more useful groupings. Fisheries management plans must account for the health of different species of fishes because they may react very differently to changing environments or fishing practices. When comprehensive fisheries and biological data are available, the sustainability of fished stocks can be assessed by data-intensive methods such as formal stock assessments. However, Somalia, like the vast majority of fished stocks around the world, lacks sufficient data for such assessment. Instead, we used methods[30] developed specifically for data-poor fisheries to classify the sustainability of fish stocks in Somalia at current levels of catch (foreign plus domestic).

We classified sustainability based on the ratio of current levels of fish biomass to the biomass needed to produce maximum sustainable yield, or MSY (B/B_{MSY}). This ratio is a common metric of sustainability used by the Indian Ocean Tuna Commission (IOTC), among others. If the ratio is greater than 1.0, the biomass of a fish stock is higher than that needed to produce MSY for the fishery. Theoretically, then, the fishery could support a higher level of fishing. If the ratio is less than 1.0, the biomass of a fish stock is below that needed to produce MSY for the fishery, and fishing levels should be reduced to improve sustainability.

Biomass is difficult to measure even in well-studied systems. In systems such as Somalia's, which lack regular scientific surveys of marine resources, it is nearly impossible. Costello[31] and colleagues developed an approach for estimating B/B_{MSY} when only catch and basic biological information are available. Using information from data-rich fish stocks from around the world, they built a statistical model[c] that related B/B_{MSY} to various fishery metrics such as how long the fishery has existed, whether catch has peaked, and the length of the fish in question. They then applied that model to over 1,700 stocks of fishes that had never been assessed before. Their analysis did not explore stocks in Somali waters, so we applied the model they developed to the catch data we have reconstructed for Somali waters.

We limited our analysis to catch from those species groups that (a) had sufficient data for analysis and (b)

c A panel regression model built from FAO catch data and validated against full stock assessments. The coefficients thereby derived were then applied to 1,793 unassessed stocks.

Box 4.1: The Potential for Investment in Somali Fisheries

As the political and security situations in Somalia stabilize, Somali and foreign businesspeople are seeking opportunities to invest. The Somali energy, telecommunications, and agriculture sectors are growing, and private sector investment promises to improve supply chains, create jobs, build civil society, increase civic participation, reduce poverty, and promote economic growth. Additionally, there is potential for Somalis to earn millions of dollars each year from licensing foreign fishing vessels, and this revenue could be used to expand the fisheries sector. Somalia's small-scale fisheries sector would benefit greatly from investment in infrastructure and services, but that investment must be targeted wisely to achieve sustainability. In the course of our research, the following sectors presented some of the most promising opportunities for investors and the Somali fishing sector:

- **Cold storage**—One of the greatest challenges to expanding fisheries in Somalia is the lack of infrastructure, especially a well-developed cold chain. Cold storage at every point along the boat-to-market continuum is crucial to maintaining the quality of fish and thereby commanding high prices, especially in export markets. Progress in the cold chain is being made through the construction of freezers made from cargo containers.[21] Increased ice-making facilities, cold storage, and freezer transport would greatly increase the value and marketability of Somali catch. In particular, a variety of freezing technologies are needed to accommodate different markets: while ice is useful for fish that will be sold domestically in short time frames, deep and flash freezers are needed to preserve fish for long time frames in the export market.

- **Fishing boats and technology**—Somali fishers are limited by the small size of their boats and lack of access to fish-finding technologies. Larger boats, navigational equipment (e.g., GPS and navigation charts), and fish-finding sonar systems would increase the ability of Somali fishers to compete with industrial and foreign vessels.

- **Sanitary processing facilities**—Somali fish products do not always adhere to the food safety and sanitary import laws of most countries,[22] and this limits the markets to which Somalis can send fish products. After preventing spoilage through greater cold storage capacity, investment in state-of-the-art sanitary processing facilities and training in international sanitation standards would open new markets for Somali fish products. Such facilities could be built in regional hubs and serve catch from a variety of smaller supply locations.

- **Small-scale tuna fisheries**—Most Somali vessels catch fish using gillnets; this precludes catching large, highly migratory (and highly profitable) tuna such as yellowfin, and gillnets create unwanted bycatch. We believe there is great potential in an artisanal pole-and-line yellowfin tuna fishery. The Maldives have leveraged their artisanal tuna fishing practices onto a larger scale, and they market their products accordingly: pole-and-line caught tuna from the Maldives is highly desired and commands above-market prices because it is certified sustainable by the Marine Stewardship Council.[23] Somalia has similar potential. Targeted investment into pole-and-line gear or longlines equipped with bycatch prevention measures could create a niche market for Somali tuna. Our analysis (§2) shows catch of highly migratory tuna in Somali waters is approaching the limits of sustainability, so increases in domestic harvest must be reconciled with the large amounts of tuna caught by foreign vessels. Somalis would earn greater income from a profitable artisanal tuna fishery than from licensing foreign vessels to land the same fish, but development of such a fishery will take time. However, there may be even greater potential for catch of the coastal species of tuna (e.g., frigate tuna, bullet tuna, or kawakawa). We caution that the IOTC does not yet perform sustainability analyses for these species, but Somali-led data collection initiatives could help fill this gap.

- **Fishmeal**—In Somalia, there is first-mover opportunity to develop fisheries for forage fishes and process those fish into fishmeal, a growing product on the international market for animal and aquaculture feed.[24, 25] Additionally, fishmeal could provide an affordable, organic, and local source of fertilizer for Somali agriculture. Our sustainability analysis shows that forage fishes (planktivores), including sardines and anchovies, are underexploited in Somali waters. To develop this opportunity, investment is needed in both the fishery itself and in building fishmeal pro-

Box 4.1: CONT'D

cessing plants. Forage fishes are subject to large population fluctuations caused by climate and natural cycles,[26] so strong fisheries management plans should first be adopted. Energy and water use considerations for fishmeal plants also must be assessed. If established wisely, sustainable harvest of forage fishes for fishmeal could produce jobs in fishing areas and away from the coast.

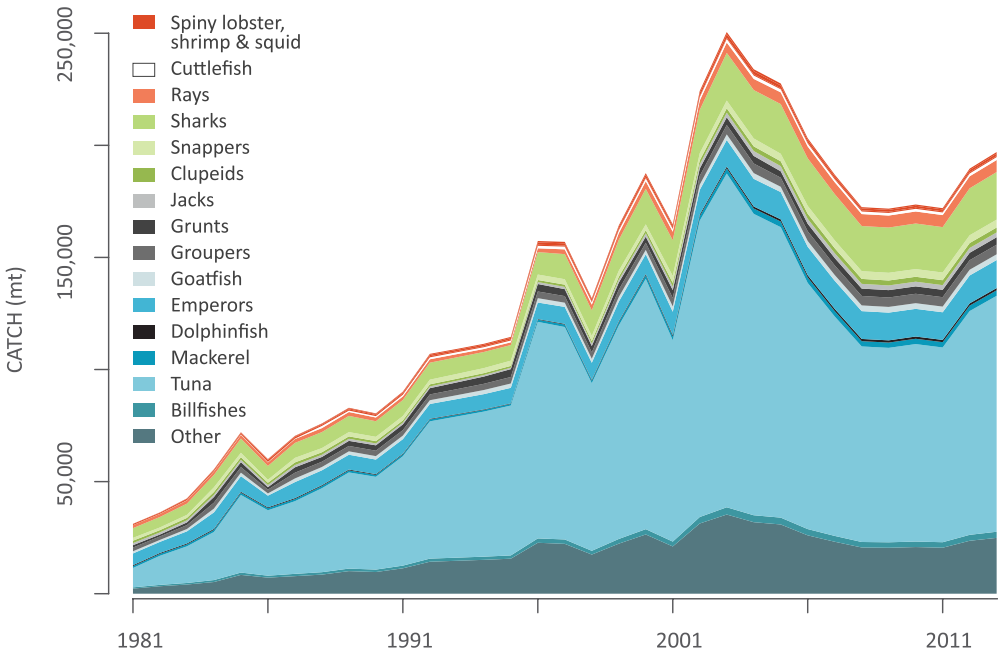
- **Shellfish mariculture**—Aquaculture is the fastest-growing food production sector in the world, but land-based systems require high water inputs. Mariculture, aquaculture that occurs in the ocean, may offer an important alternative in water-strapped Somalia.[27] Coastal culturing of mussels, in which mussels are grown on rafts, ropes, or poles and harvested by hand, is one of the most sustainable forms of aquaculture in the world.[28] Mussels are extremely nutritious, and mussel farms have been highly profitable in suitable locations. Although suitability studies and environmental impact assessments are needed for Somali waters, mussel mariculture may be a creative and lucrative opportunity.[29]

were not highly migratory species (HMS). HMS stocks undergo more rigorous sustainability analysis by the IOTC, and we defer to and report their results for HMS below.

We used combined foreign and domestic catch estimates for dolphinfish, emperors, goatfish, jacks, clupeids, snappers, sharks, rays, groupers, and grunts (Figure 4.4). Uncertainty in catch reconstructions at the species level and limitations with the sustainability model precluded analysis of individual species. Maximum length of each fish group (calculated as an average across species in that group) was included as a biological parameter in the model. Although we have catch reconstructions for squid, shrimp, spiny lobster, and cuttlefish in Figure 4.4, the sustainability model produced by Costello et al. did not include these groups. See Appendix 6 for further methodological details.

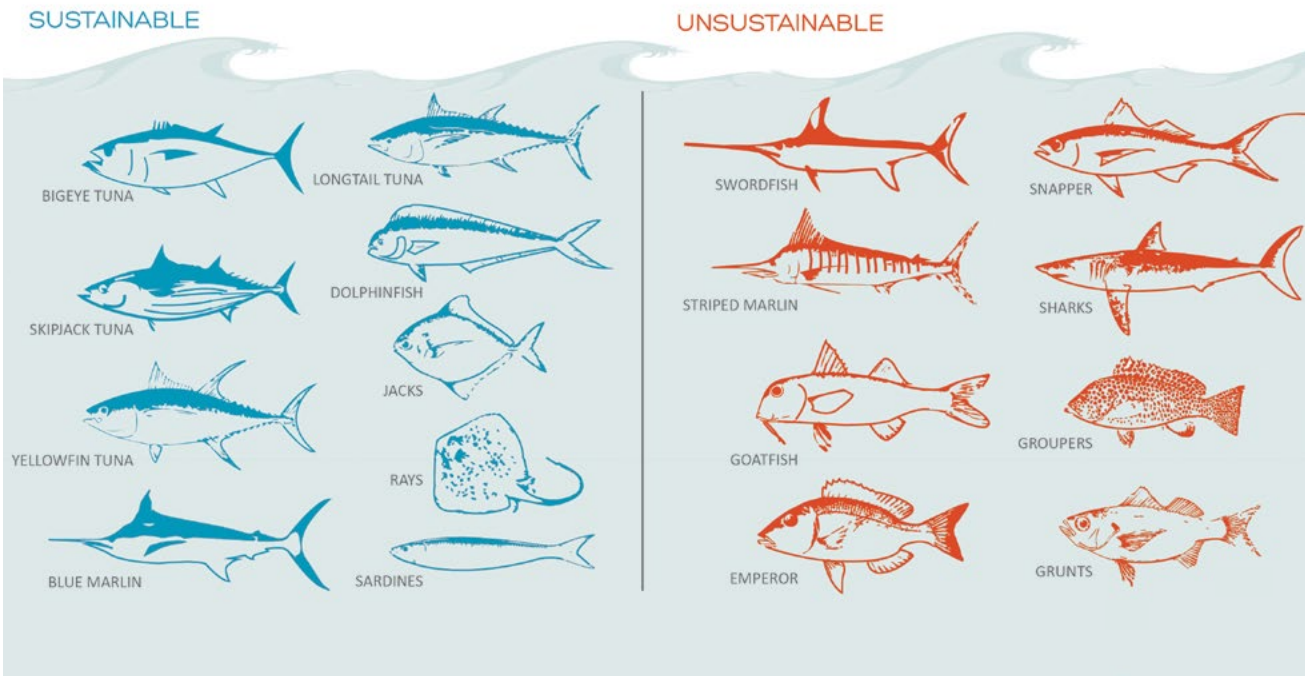
We find 8 of the 17 fish groups we analyzed are currently fished at unsustainable levels (Figure 4.5). These include swordfish, striped marlin, emperors (including the commercially important spangled emperor, *Lethrinus nebulosus*), goatfish, snappers, sharks, groupers, and grunts (including the commercially important painted sweetlips, *Diagramma pictum*).

FIGURE 4.4 Fisheries catch (foreign and domestic) in Somali waters by species group.



We urge caution when interpreting these results. First, the analysis was done on categories of catch that range from species (e.g., yellowfin tuna) to groups of families (e.g., sharks). Results found for aggregated categories do not translate to the species that make up that group,

FIGURE 4.5 Sustainability of commercially-fished stocks in Somali waters.



and variation between species will occur. Second, for the non-HMS species, the analysis was based on catch reconstructions. The methodology used for these reconstructions (see Chapters 2 and 3) creates patterns in the data that are different from those that would exist in real observations of catch (i.e., higher autocorrelation). However, the creators of the sustainability model found catch underreporting and misreporting did not affect results. Third, our classification scheme creates a clear line (B/B_{MSY} = 1.0) above which a group was classified as sustainable and below which it was classified as unsustainable. Some categories have B/B_{MSY} values near 1.0 and could plausibly be classified another way if data were slightly different. Likewise, some categories had B/B_{MSY} much greater than 1.0 suggesting high levels of sustainability, while others had B/B_{MSY} much lower than 1.0, suggesting immediate conservation measures are needed. Our catch estimates are not robust enough for additional interpretation.

4. CONCLUSIONS

There are reasons to be optimistic about sustainability of fisheries in Somalia. On average, fisheries in Somalia are more sustainable than in the rest of the world. In two analyses, 63%[43] and 64% of global stocks were found to be unsustainable (with B/B_{MSY} below 1.0). By comparison, less than half of the categories we analyzed are unsustainable in Somali waters. None of the Somali fisheries are collapsed, while worldwide 24% are collapsed. Some of the most lucrative species, particularly yellowfin and skipjack tuna, appear to be healthy. And the species most likely to be turned into fishmeal (clupeids) also appear sustainable at current levels.

However, caution is warranted. On average, global fish stocks had comparable levels of sustainability in 1978 (66% sustainable, 44% unsustainable), but a mere 13 years later sustainability had declined such that 64% of stocks were unsustainable, a level that persists 25 years later. Somali fish stocks may have an advantage over global stocks because the history of industrial-level fishing in its waters began much later and increased more slowly. If Somali stocks follow a path similar to that taken by global stocks, we estimate more than half of stocks will be unsustainable in under a decade.

Fisheries have the potential to yield significant income, nutrition, and employment for Somalis. The strides made recently to build a foundation for management and ownership of fisheries by Somalis is a critical step towards greater sustainability in the future.

Box 4.2: Conservation of Overlooked Species

Many species with vulnerable, threatened, or endangered conservation status live in Somali waters, including whale sharks, sea turtles, cetaceans, seabirds, and sea cucumbers. These groups may be targeted or captured as bycatch in the gillnet, trawl, longline, and purse seine fisheries. Proper protection and management is hindered by a severe lack of data. Catch of these species in the Indian Ocean is frequently underreported because it is not required by individual nations, and because vessels fear the consequences of reporting illegal capture of threatened species where such laws exist.[32] The high bycatch rates associated with gillnet vessels, deployed by the two foreign fleets with the largest presence in Somali waters (Iran and Yemen), is cause for concern.

Whale Sharks

Whale sharks (*Rhincodon typus*) range throughout the Indian Ocean, and tagging experiments confirm their presence in Somali waters.[33] Targeted fisheries for this species, which is listed as Vulnerable by the International Union for Conservation of Nature,[34] have been banned in many Indian Ocean countries, and whale sharks have been protected to promote ecotourism in the Seychelles. Unfortunately, these massive filter-feeding sharks are subject to accidental mortality in gillnet, purse seine, and driftnet fisheries.[35]

Sea Turtles

Of the seven species of sea turtles worldwide, five live in Somali waters, all of which are protected by various international treaties.[36] The green turtle (*Chelonia mydas*) and hawksbill turtle (*Eretmochelys imbricata*) range throughout the Western Indian Ocean and nest on northern Somali beaches.[37] Sea turtles are extremely vulnerable to entanglement in gill nets,[38] so they are often captured incidentally by foreign fishers and Somali fishers who keep them to sell their meat. In our survey of Somali fishers (Appendix 1), 22% of respondents reported that they had caught turtles and that they fetched between US $0.50 -$15.00 per kg. These high prices incentivize fishers to keep accidentally caught turtles rather than release them.

Seabirds

Seventeen species of seabirds live in Somalia. Worldwide, seabird populations are on the decline.[39] Seabirds are primarily surface feeders, scanning the waves for prey in the top few meters of water. These eating habits mean they are easily enticed by baited longlines[40] or the dead fish in gillnets.[41] Both gears pose threats to birds which can drown if hooked on a line or entangled in a net. Unfortunately, the number of seabirds accidentally caught in the Indian Ocean is entirely unknown. We believe that with the heavy use of gillnets and longlines in Somali waters, unreported seabird mortality in this region is likely high.

Sea Cucumbers

Little is known about the size of the sea cucumber fishery or the status of their populations in Somali waters. According to our survey of Somali fishers, processors, and exporters, sea cucumbers are captured by Somali fishers for export and they fetch a high price compared to most fish species: between US $60 and $92 per kg, depending on the market. Worldwide, few sea cucumber management plans exist and those that do are undermined by a lack of knowledge.[42] Given their high value and lack of management, sea cucumbers are poised to be overfished in Somali waters.

The recently enacted Somali Fisheries Law calls for the protection of “endangered marine animals,” prohibits fishing for endangered animals, and mandates release of accidentally caught endangered marine animals. Additionally, fishers are obligated to report quantities and types of bycatch.* Upon joining the IOTC, Somalia began the process of coming into compliance with Conservation and Management Measures (CMMs). CMMs are binding resolutions with which IOTC Member nations comply, and they provide a framework for reducing bycatch and

Box 4.2: CONT'D

protecting threatened and endangered species. CMMs for the protection of whale sharks, turtles, and seabirds exist, but they do not exist for sea cucumbers. These are excellent first steps toward conserving threatened species; however fishers, both local and foreign, need to be better informed of these regulations and their consequences, and enforcement of the law is crucial for the protection of these sensitive species. Over the next few decades, as stability in Somalia grows, the conservation of these species today is critical to ecosystem function and societal development (e.g., ecotourism) in the future.

*Article 25 of the Somali Fisheries Law

Coastal tuna from Somali waters, Jean-Pierre Larroque

REFERENCES

1 Pauly, D., Christensen, V., Guénette, S., Pitcher, T.J., Sumaila, U.R., Walters, C.J., …Zeller, D. (2002). Towards sustainability in world fisheries. *Nature*, 418(6898), 689–695. doi:10.1038/nature01017

2 Froese, R., Zeller, D., Kleisner, K., & Pauly, D. (2012). What catch data can tell us about the state of global fisheries. *Marine Biology,* 159(6), 1283–1292. doi:10.1007/s00227-012-1909-6

3 Ibid.

4 Worm, B., Barbier, E. B., Beaumont, N., Duffy, J. E., Folke, C., Halpern, B. S., … Watson, R. (2006). Impacts of Biodiversity Loss on Ocean Ecosystem Services. *Science*, 314(5800), 787–790. doi:10.1126/science.1132294

5 Worm, B., Hilborn, R., Baum, J. K., Branch, T. A., Collie, J. S., Costello, C., ... Zeller, D. (2009). Rebuilding global fisheries. *Science*, *325*(5940), 578–585. doi:10.1126/science.1173146

6 Jackson, J. B. C. (2001). Historical Overfishing and the Recent Collapse of Coastal Ecosystems. *Science*, 293(5530), 629–637. doi:10.1126/science.1059199

7 Cochrane, K. L. (2000). Reconciling sustainability, economic efficiency and equity in fisheries: the one that got away? *Fish and Fisheries*, 1(1), 3–21. doi:10.1046/j.1467-2979.2000.00003.x

8 Béné, C. (2009). Are Fishers Poor or Vulnerable? Assessing Economic Vulnerability in Small-Scale Fishing Communities. *Journal of Development Studies*, 45(6), 911–933. doi:10.1080/00220380902807395

9 Rosenberg, A.A., Fogarty, M.J., Cooper, A.B., Dickey-Collas, M., Fulton, E.A., Gutiérrez, N.L., …Ye, Y. (2014). Developing new approaches to global stock status assessment and fishery production potential of the seas. FAO Fisheries and Aquaculture Circular No. 1086. Rome: FAO. 190 pp. Retrieved from http://www.fao.org/docrep/019/i3491e/i3491e00.htm

10 Ibid.

11 Haakonsen, J. M. (1983). Somalia's Fisheries Case Study. In *Case Studies and Working Papers Presented at the Expert Consultation on Strategies for Fisheries Development* (pp. 170–184). Rome: FAO.

12 Yassin, M. (1981). *Somalia: Somali Fisheries Development and Management*. Retrieved from www.mbali.info/doc278.htm

13 Ibid.

14 Stromme, T. (1984). Cruise Report R/V "Dr. Fridtjof Nansen": second fisheries resource survey north-east coast of Somalia 24–30 August 1984. *Reports on Surveys with the R/V Dr Fridtjof Nansen*. Bergen, Norway: Institute of Marine Research.

15 Haakonsen, Somalia's Fisheries Case Study

16 Hassan, M. G. and Tako, M. H. (1999). Illegal Fishing and Dumping Hazardous Wastes Threaten the Development of Somali Fisheries and the Marine Environments. In Tropical Aquaculture and Fisheries Conference 99, 7th–9th September 1999, Terengganu, Malaysia. Retrieved from http://www.geocities.com/gabobe/illegalfishing.html

17 Rosenberg et al., Developing new approaches

18 M. Fogarty (personal communication, 4 August 2015).

19 Large Marine Ecosystems of the World. http://lme.edc.uri.edu

20 Rosenberg et al., Developing new approaches

21 New Ice Plant to Boost Somaliland Fisheries Sector. (2015, May 1). *The Fish Site*. Retrieved from http://www.thefishsite.com/fishnews/25589/new-ice-plant-to-boost-somaliland-fisheries-sector/

22 Government of Somaliland Ministry of Trade and Investment. (2014). *An Investment Guide to Somaliland Opportunities and Conditions 2013–2014*. Retrieved from http://somalilandinvest.net/somaliland_investment_guide.pdf

23 Magudia, R. (2013, August 30). How pole and line fishing enables sustainability in the tuna market. *The Guardian*. Retrieved from http://www.theguardian.com/sustainable-business/pole-line-fishing-sustainability-tuna-market

24 Craft, M. (2010, September 9). Emerging markets offer growth, and fishmeal. *Associated Press*. Retrieved from http://www.deseretnews.com/article/700066861/Emerging-markets-offer-growth-and-fishmeal.html?pg=all

25 The World Bank. (2013). *Fish to 2030: Prospects for Fisheries and Aquaculture* (Report Number 83177-GLB, Agriculture and Environmental Services Discussion Paper 03). Retrieved from http://www.fao.org/docrep/019/i3640e/i3640e.pdf.

26 Schwartzlose, R. A., Alheit, J., Bakun, A., Baumgartner, T. R., Cloete, R., Crawford, R. J. M., … Zuzunaga, J. Z. (1999). Worldwide large-scale fluctuations of sardine and anchovy populations. *South African Journal of Marine Science*, 21(1), 289–347. doi:10.2989/025776199784125962

27 Tidwell, J.H. & Allan, G.L. (2001). Fish as food: aquaculture's contribution. *EMBO Reports*, 2(11), 958-963. doi:10.1093/embo-reports/kve236

28 Food and Water Watch. (2010). Farming Oysters, Clams, and Mussels (Issue Brief). Retrieved from http://documents.foodandwaterwatch.org/doc/shellfishIB-web.pdf.

29 Delmendo, M. N. (1989). Bivalve farming: an alternative economic activity for small-scale coastal fishermen in the ASEAN region. ASEAN/UNDP/FAO Regional Small-Scale Coastal Fisheries Development Project. Retrieved from http://www.fao.org/docrep/field/009/ag163e/ag163e00.htm.

30 Costello, C., Ovando, D., Hilborn, R., Gaines, S.D., Deschenes, O. Lester, S.E. (2012). Status and solutions for the world's unassessed fisheries. *Science,* 338(6106), 517–520.

31 Ibid.

32 MRAG. (2012). *A review of bycatch in the Indian Ocean gillnet tuna fleet focusing on India and Sri Lanka*. Washington, D.C.: International Seafood Sustainability Foundation. Retrieved from http://iss-foundation.org/wp-content/uploads/downloads/2012/05/ISSF-2012-05-IO-Gillnet-Bycatch.pdf

33 The Pew Charitable Trust. (2012, February 7). Fact Sheet: Whale Sharks. Retrieved from http://www.pewtrusts.org/en/research-and-analysis/fact-sheets/2012/02/07/whale-sharks

34 Norman, B. (2005). Rhincodon typus. *The IUCN Red List of Threatened Species*. Version 2015.2. Retrieved from http://www.iucnredlist.org/details/full/19488/0

35 Ibid.

36 Sommer, C., Schneider, W., & Poutiers, J.-M. (1996). *The Living Marine Resources of Somalia*. Rome: FAO.

37 Schleyer, M. H., & Baldwin, R. (1999). *Biodiversity Assessment of the Northern Somali Coast East of Berbera*. IUCN East Africa Programme.

38 Bourjea, J., Nel, R., Jiddawi, N. S., Koonjul, M. S., & Bianchi, G. (2008). Sea turtle bycatch in the West Indian Ocean: Review, recommendations and research priorities. *Western Indian Ocean Journal of Marine Science*, *7(2)*, 137–150. Retrieved from http://www.researchgate.net/publication/232416462_Sea_Turtle_Bycatch_in_the_West_Indian_Ocean_Review_Recommendations_and_Research_Priorities

39 Worrying declines for world's seabirds. (2012, March 9). *The IUCN Red List of Threatened Species*. Retrieved from http://www.iucnredlist.org/news/worrying-declines-for-worlds-seabirds

40 Brothers, N. P., Cooper, J., & Løkkeborg, S. (1999). The incidental catch of seabirds by longline fisheries: worldwide review and technical guidelines for mitigation. *FAO Fisheries Circular*, (937) 100p.

41 MRAG, *A review of bycatch in the Indian Ocean*

42 Purcell, S. W., Mercier, A., Conand, C., Hamel, J. F., Toral-Granda, M. V., Lovatelli, A., & Uthicke, S. (2013). Sea cucumber fisheries: Global analysis of stocks, management measures and drivers of overfishing. *Fish and Fisheries*, 14(1), 34–59. doi:10.1111/j.1467-2979.2011.00443.x

43 Worm et al., Rebuilding global fisheries

CHAPTER 5. OPPORTUNITIES FOR DEVELOPING SOMALI MARINE FISHERIES

This is a critical moment for ensuring the sustainability of Somali fisheries resources and protecting the interests of Somali fishers and those who rely on fisheries for income and food security. There is considerable (and growing) commercial, development, and political interest in Somali fisheries, and the foundation to support sustainable development of Somalia's rich marine waters is being laid. Specifically:

- In April 2014, agreement was reached among representatives of the Federal Government of Somalia (FGS), Somaliland, Puntland, Jubaland, and Galmudug to cooperate on fisheries management through federal licensing schemes for highly migratory species (HMS) and Somali regional licensing of coastal and demersal fishes.[1]
- In May 2014, Somalia joined the Indian Ocean Tuna Commission (IOTC) and thereby engaged the international community in shared management of tuna and tuna-like species and adoption of Conservation and Management Measures (CMMs).[2]
- In June 2014, Somalia proclaimed its Exclusive Economic Zone (EEZ), strengthening its legal foundation for fisheries management, especially with respect to foreign vessels in Somali waters.[3]
- In October 2014, the parliament adopted updated draft fisheries legislation, the Somali Fisheries Law (Law n°29), which was signed by President Hassan Sheikh Mohamud in November 2014. This legislation prioritizes sustainability, promotes cooperation between the FGS and regional administrations, recognizes the importance of including fishers' perspectives in fisheries management, and takes a strong stand against IUU fishing.

Fishermen in Berbera, Jean-Pierre Larroque

Despite progress Somalis have made to protect their fisheries, the people of Somalia continue to face legal, structural, and political challenges. Somalia and its littoral regions have asked the international community for assistance in developing necessary physical infrastructure and scientific capacity to achieve sustainable fisheries management.[4] Based on Secure Fisheries' assessment of the ecological status of Somali fisheries, their economic importance, and the scale of foreign fishing in Somali waters, we outline opportunities for achieving three primary goals: (1) policies and structures to combat illegal, unreported, and unregulated (IUU) fishing, (2) a foundation for sustainable fisheries management aimed at promoting food and economic security for Somalis, and (3) a stronger international effort to stop destructive fishing practices by foreign vessels in Somali waters.

These proposals were developed through interviews with Somali fisheries managers, discussions with Somali fishers and processors, consultation with regional experts and representatives of NGOs and international organizations, and information collected from published laws, communiqués, and reports. While none of these groups has a universal perspective, we hope that by collecting as many viewpoints as possible, our proposals reflect the wishes of the Somali people.

BOX 5.1: SUMMARY OF OPPORTUNITIES

Secure Fisheries' analysis of the sustainability and economic importance of Somali fisheries, coupled with conversations with Somali fishers, fisheries authorities, entrepreneurs, and fisheries experts supports the following proposals for achieving three goals that will responsibly develop Somali fisheries:

Goal 1. Developing Policies and Structures to Combat IUU Fishing

1.1 Form consensus on foreign vessel licensing and revenue sharing schemes, and invest funds in the Somali fishing sector.

1.2 Develop monitoring, control, and surveillance capacity for the domestic and foreign licensed fleets by finalizing a Fisheries Monitoring Center and requiring Vessel Monitoring Systems on all foreign licensed vessels and on semi-industrial and industrial domestic fishing vessels.

1.3 Require landing certificates and procedures that increase the traceability of fish caught in Somali waters.

1.4 Ratify and implement the Port State Measures Agreement.

1.5 Actively participate in the IOTC management process, including mandatory data reporting, compliance with Conservation and Management Measures, and participation at meetings.

Goal 2. Building a Foundation for Sustainable Fisheries Management

2.1 Expand efforts to collect fisheries data, including reporting from domestic and foreign fishing vessels, landing site data collection and sampling programs, logbook systems for large vessels, fisheries observer programs, and communication of data collection and analysis to fishery stakeholders.

2.2 Disseminate the Somali Fisheries Law put forth by the Federal Government of Somalia.

2.3 Continue and advance fisheries infrastructure development projects.

2.4 Develop new and comprehensive fisheries regulations that advance the goals for fisheries management established by Somali law.

2.5 Prioritize species or stocks for which management plans should be developed.

2.6 Consider the implementation of Territorial Use Rights for Fisheries programs for coastal and demersal species.

2.7 Encourage coordination between federal and regional fisheries authorities in support of a unified Federal Somali Fisheries Authority.

2.8 Implement the provision of the Somali Fisheries Law that bans bottom trawling in Somali waters.

Goal 3. An International Call to Action to Stop Illegal and Destructive Foreign Fishing

3.1 Require flag-states to compel registered vessels to comply with Somali legislation and enforce sanctions when violated.

3.2 Support data and information sharing initiatives and identify vessels fishing in Somali waters without licenses or using destructive fishing practices.

3.3 Increase import restrictions on IUU fish.

3.4 Enforce inspections of all vessels fishing in Somali waters but landing catch outside Somalia.

3.5 Hold owners responsible for the actions of their vessels, even if flagged to a different nation.

3.6 Support Indian Ocean regional agreements to end IUU fishing throughout the Indian Ocean that increase the use of Automatic Identification Systems on fishing vessels, strengthen the regional coordination of law enforcement and prosecutorial actions against fisheries crime, and adopt mandatory, unique, and permanent ship identification numbers.

GOAL 1. DEVELOPING POLICIES AND STRUCTURES TO COMBAT IUU FISHING

High levels of foreign IUU fishing (Chapter 2) are compromising the sustainability of fish stocks (Chapter 4) in Somali waters and this puts the livelihoods of Somali fishers at risk. Since 1991, the legal status of foreign fishing vessels in Somali waters has been ambiguous. Somaliland and Puntland overcame a governance vacuum at the federal level by issuing licenses to foreign vessels. However, these licenses have not been universally recognized. Many foreign vessels took advantage of the lack of a centralized authority and an internationally accepted EEZ boundary to fish in Somali waters without attempting to gain permission. Finally, corruption and a lack of transparency have encouraged foreign vessels to obtain false or quasi-legal licenses that are sold without proper authority. The ambiguous legal status of foreign vessels has had disastrous impacts. Somali waters are a free-for-all where foreign vessels fish with impunity and without regard for Somali fishers or resources. Foreign vessels are vulnerable to arrest and to dangerous pirate attacks. Adding to the frustration within Somali fishing communities, Somali fishers have had no recourse for protecting their resources. The recent proclamation of the EEZ boundary by the FGS is an important first step in rectifying this problem. To further improve fisheries governance and combat IUU fishing, we highlight opportunities for Somalia, Somaliland, and the Somali regions to:

1.1. Form consensus on foreign vessel licensing and revenue sharing schemes, and invest funds in the Somali fishery sector. To reduce IUU fishing, federal and Somali regional governments recognized the need for licensing of foreign vessels in Somali waters,[5] including a revenue sharing agreement and regulations on the number of boats and allowable gear. The new Somali Fisheries Law addresses many related factors. Article 16 §3 makes foreign fishing allowances conditional on surplus fishery resources only after allowing for domestic harvest. Article 15 requires licenses for foreign vessels to be obtained through the Ministry of Fisheries and Marine Resources. However, distribution of revenue from the issuance of licenses among the federal government, Somaliland, and the Somali regions, including those without a coastline, has yet to be determined. While a solution to revenue sharing is politically fraught, we emphasize its importance for providing legal and regulated avenues for foreign vessels to fish inside Somali waters when resources are determined to be sufficient. Therefore, Secure Fisheries recommends adherence to the Somali Maritime Resource and Security Strategy (SMRSS) Communiqué of April 2014[a] whereby non-highly migratory species would be licensed and managed at the Somali regional level while vessels fishing for HMS stocks, namely tuna, would be licensed at the federal level *after* revenue sharing is agreed upon. Deciding on a revenue sharing agreement[b] before the 2016 tuna season would maximize revenue. Based on our analysis in Chapter 2, we conclude that a properly run licensing program could generate millions of dollars of revenue that will be most beneficial to Somali fishers if it is immediately invested in the fishery sector, especially in data collection, fisheries infrastructure, and port-based maritime support services.

1.2. Develop MCS capacity for the domestic and foreign licensed fleets by finalizing a Fisheries Monitoring Center and requiring Vessel Monitoring Systems on all foreign licensed vessels and on semi-industrial and industrial domestic fishing vessels. Monitoring, control, and surveillance (MCS) is a key component of fisheries management and its effective implementation can serve as both a deterrent and enforcement mechanism to combat IUU fishing. Domestic MCS development has been slow and Somalis have requested the help of the international community.[6] Recognizing the long timeframe and challenges associated with developing full MCS capacity, first-step measures for MCS in Somali waters could include: (1) the finalization of a Somali-run Fisheries Monitoring Center (FMC) to serve as the central clearinghouse for port inspections, Vessel Monitoring System (VMS) data collection, information sharing, and tracking of vessels; (2) a requirement for all semi-industrial and industrial domestic vessels fishing within Somali waters to broadcast VMS at all times; (3) a requirement that all foreign fishing vessels operating in Somali waters broadcast both VMS and Automatic Identification Systems (AIS) at all times; and (4) the joining of Indian Ocean IUU efforts with other state actors. VMS refers broadly to systems of

a Agreed upon by the Federal Government of Somalia, the state of Somaliland, and the regions of Puntland, Galmudug, and Juba, April 6, 2014.

b Somali Maritime Governance Workshop, supported by the International Maritime Organisation, held in Addis-Ababa, Ethiopia, 14–17 April 2014. This agreement expired in December 2014.

tracking and identification used on fishing vessels so regulatory agencies can monitor fishing activities. The exact technologies used, and information required, vary by nation. Since 2006, the IOTC has required all fishing vessels above 15m in length and listed on the IOTC Record of Authorized vessels to use VMS. It would benefit Somali fishers to broaden that mandate to include foreign vessels fishing for species other than those managed by IOTC. The Seychelles model of VMS and MCS has been successful, and following recommendations made at the April 2014 SMRSS Fisheries Working Group, we encourage further collaboration with Seychellois fisheries authorities in this arena.

1.3. Require landing certificates and procedures that increase the traceability of fish caught in Somali waters. Traceability refers to the ability to track a seafood product throughout the supply chain, from harvest to plate; it can serve as a useful tool to ensure legality and sustainability of a product and increase product value in the international marketplace. Challenges to achieving traceability of Somali fisheries products are grounded in the lack of established traceability policies in the global fisheries sector. Recognizing these challenges, Somali authorities could establish procedures for data collection and licensing that include traceability considerations. For example, any data collection policy could include fish caught in Somali waters that are landed in another country or are transferred or sold at sea (transshipped). Additionally, as required in the Somali Fisheries Law,[c] foreign vessels should demonstrate that they are properly documenting their catch from Somali waters when it is landed or transferred as a pre-requisite for renewing a fishing license. To this end, the current law requires logbooks, the use of a uniform template, and regular catch reporting by foreign vessels as a mandatory condition for obtaining a license to fish in Somali waters. Non-compliance with these conditions should be reason for fine and suspension or non-renewal of license.

1.4. Ratify and implement the Port State Measures Agreement. Among the most effective tools for combating IUU fishing are port state measures. Port state measures are recommended or required actions for fishing vessels entering a port and are designed to minimize the likelihood of landing IUU catch. They are implemented by state authorities and require foreign fishing vessels to comply or lose their right to land fish or use facilities. These measures include the inspection of fishing licenses, catch certificates, and gear restrictions. The Port State Measures Agreement (PSMA),[7] developed by the Food and Agriculture Organization of the United Nations (FAO) and adopted in 2009, will come into force after ratification by 25 nations.[d] It aims to harmonize port state measures around the world and increase cooperation on the reduction of IUU fishing. Because foreign vessels do not currently land in Somali ports, Somalia would benefit from greater PSMA adherence by other countries' ports. The Seychelles, Oman, Sri Lanka, and Mozambique have already ratified the PSMA, and we encourage other Indian Ocean governments to follow suit. While political challenges, such as the authority to ratify, will complicate its ratification by the FGS, the PSMA has the potential to reduce IUU fishing globally. As a member of the IOTC, Somalia has already agreed to comply with IOTC Resolution 10/11 on Port State Measures; its mandates are nearly identical to those contained in the PSMA. Secure Fisheries encourages Somali authorities to ratify the Port State Measures Agreement and fully implement the provision of IOTC Resolution 10/11 on Port State Measures to reduce the ability of IUU fishing vessels to land Somali fish in other ports.

> ***I see [foreign fishing] as illegal. I am requesting the United Nations to act and do something about this as soon as possible.***
>
> **Fisher from Puntland**

1.5. Actively participate in the IOTC management process, including mandatory data reporting, compliance with Conservation and Management Measures, and participation at meetings. In June 2014, Somalia met one of its goals outlined in the SMRSS[8] and joined 31 other nations in becoming an active member of the IOTC. Regional Fisheries

c Article 12 §6

d As of August 31, 2015, the PSMA has been ratified by Australia, Chile, the EU, Gabon, Iceland, Mozambique, Myanmar, New Zealand, Norway, Oman, Saint Kitts and Nevis, Seychelles, Sri Lanka, and Uruguay.

Somaliland Fair Fishing, Jean-Pierre Larroque

Management Organization membership comes with privileges, and, more importantly, with responsibilities. We support the coastal regions and the FGS in coordinating data sharing to provide comprehensive, timely, and accurate fisheries data for the creation of one unified annual report to the IOTC on the state of Somali fisheries. A Somali delegation attended the Nineteenth Session of the IOTC in South Korea in April 2015 and presented its annual report and a report[9] on presumed IUU fishing activities in Somali waters. We further encourage Somali officials to participate at all levels of the IOTC (e.g., attendance at scientific meetings, Coastal State Initiatives, and direct coordination with states with similar concerns). The FGS should continue to work with Somali regions both before and after IOTC meetings to bring the messages of the regions to the IOTC, and to return the messages of IOTC Conservation and Management Measures (CMMs) to the regions. Somalis will benefit from consistency in choosing ministry representatives for their delegation to the IOTC. This will achieve the highest level of lasting institutional knowledge and continuity of process—a delegation that can be trained in IOTC methods and policies and attend year after year. IOTC funds are available to support delegation participation, and Somalia can submit applications for those funds. Additional funds could be generated from revenue from licensing foreign vessels. Regular contributions to the IOTC management process will solidify Somali influence and protect Somali interests in the future. Finally, we recommend that all IOTC member nations actively encourage and support Somali participation in meetings, management decisions, and report generation.

GOAL 2. BUILDING A FOUNDATION FOR SUSTAINABLE FISHERIES MANAGEMENT

The SMRSS Fisheries Working Group emphasized the importance of sustainable fisheries management to Somalis. When asked by Secure Fisheries, fishers from Somaliland and Puntland agreed more fisheries management is needed and current management is ineffective.[e] The new Somali Fisheries Law (see Chapter 1) is a good foundation on which to build management plans that prioritize the livelihoods of Somali fishers, sustainability, and long-term development of Somali fisheries. Many of the steps recommended here require funding for implementation, and we suggest that revenue generated from licensing foreign vessels be allocated to these projects (see Chapter 2). To encourage sustainable fisheries management, there are opportunities to:

2.1 Expand efforts to collect fisheries data. As noted throughout this report, the lack of consistent and rigorous fisheries data presents a significant challenge to sustainable fisheries management. Current efforts by Somalis, including data collection by domestic NGOs, are important but piecemeal. Collection and reporting of catch and effort data by both domestic and foreign vessels must be increased.

- *Enforce legislative requirements on reporting from domestic and foreign fishing vessels as a condition for licensing.* The new Somali Fisheries Law mandates reporting from all domestic and foreign vessels fishing in Somali waters. However, most fishers (87%)[10] are unaware of the reporting requirement or to whom they should report their landings data. Mechanisms for submitting reports and enforcement of this provision are still needed. Secure Fisheries recommends collection of, at a minimum, the following information on all domestic industrial and artisanal catch in Somali waters: total catch (weight)

e In response to the question, "How do you feel about current fisheries management?" 69% (n=32) responded, "Not enough management." In response to the question, "Do you think current fisheries management is effective?" 56% (n=36) responded "No." See Appendix 1.

Somali fishing boats, courtesy of Jama Mohamud Ali

per species, size and weight/length of fish, location and date of catch, gear and effort, ex-vessel price earned, and any associated bycatch. Foreign vessels should be required to report the same information as domestic vessels, as well as port of landing. For vessels targeting tuna and tuna-like species, data reporting must follow the minimum requirements set out in IOTC Conservation and Management Measures.[f] For these HMS and associated bycatch, data needs to be collected continuously, organized, analyzed, and submitted to IOTC as per their requirements[g] in order to provide data that will benefit Somali fisheries managers. A secure location to store electronic databases of reported catch also is needed.

- *Develop landing site data collection, sampling programs, and logbook systems for large vessels.* Though the Somali Fisheries Law requires logbooks in order for domestic or foreign fishers to receive a fishing license,[h] there is currently no uniform or coordinated way for data to be collected from small-scale fishers, either through sampling schemes or through direct catch reporting. Onboard observers are not feasible on small vessels. Data collection at landing sites would generate needed information on the status of fisheries and ensure fishers are following regulations. These programs could be unannounced and randomized by site to maximize spatial coverage and minimize costs. Funding for these programs could come from revenue generated by license fees, and the international community, in consultation with local fisheries, could be involved in funding and training.

- *Require and fund fisheries observer programs.* Observer programs supplement reporting requirements by verifying data collection and monitoring compliance by domestic and foreign fishers. Observers should be trained in the fishery regulations of Somalia and in relevant data collection protocols, in particular for tuna and tuna-like fisheries, and should follow the IOTC minimum requirements for observer programs.[i] Observer tenure aboard fishing vessels should be paid for by the vessel owner; to ensure observers are paid, the ministry could collect payment from vessels and authorize distribution to observers. Foreign vessels should be required to admit and comply with observer requests as a condition of licensing. Small vessels, whether domestic or foreign, cannot accommodate observers; therefore, regulations should specify the size of vessel for which observers should be deployed. The Djibouti Regional Maritime Training Center, in conjunction with the FAO, has trained 24 Somali observers from the Federal Ministry—from Puntland, Jubaland and Galmudug, and from Somaliland—in Personal Survival Techniques, a minimum requirement for observers to board fishing vessels. However, more technical training in data collection and observer tasks needs to be completed for most of the observers. This effort should be expanded to the entire country with observers placed on large domestic and foreign licensed vessels. Observer activities should adapt to take into account new fisheries regulations as they are implemented. Though this could be a state-run effort, many worldwide observer organizations are private businesses contracted by the country where they send their observers. Observer training programs are costly and time-consuming to implement, but the information they gather and compliance they ensure are crucial to effective fisheries management.

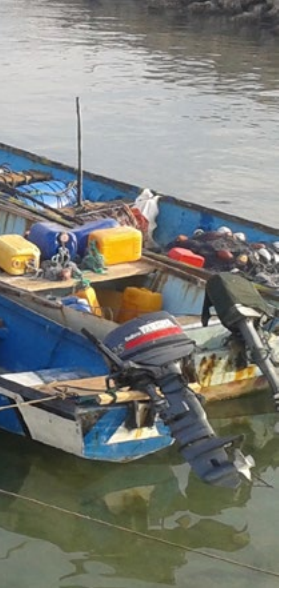
- *Communicate the findings of data collection and analysis to fishery stakeholders.* Collected data

f Currently IOTC Resolution 13/03 to be superseded by IOTC Resolution 15/01

g Currently IOTC Resolution 10/02 to be superseded by IOTC Resolution 15/02

h Article 12 §6

i IOTC Resolution 11/04



will be most effective if archived by Somali fisheries scientists and presented at annual meetings with Somali managers to update current legislative instruments or formulate new ones as needed. Somali fishers, data collectors, scientists, managers, and legislators will benefit from data sharing and, most importantly, from collaboration on analyses of stock status and indicators in order to spread awareness of stock health and catch early warning signs of declines in fish catch that may signal overfishing.

2.2 Disseminate the Somali Fisheries Law put forth by the Federal Government of Somalia. Secure Fisheries commends the Ministry of Fisheries and Marine Resources for updating its fisheries law and, in particular, for the law's mandate of sustainable management and protection of living marine resources,[j] its emphasis on active consultation and cooperation with fishers and Somali regional authorities,[k] and its aggressive approach to controlling foreign and illegal fishing.[l] The law contains important considerations to be decided in consultation with Somaliland and the regions, such as license revenue sharing; we encourage regional fisheries authorities to work in cooperation with the federal government to coordinate such efforts. A recent study[11] shows fishers are unaware of the provisions of the new law; therefore, it must be communicated more widely for adoption to be successful. Consistency between federal and regional laws and regulations will help stakeholders with planning and investment decisions and will improve the effectiveness of management at all levels.

2.3 Continue and advance fisheries infrastructure development projects. Poor infrastructure has been a major impediment to the expansion of domestic fisheries. Fishers across the country agree[12] that there is inadequate transportation and fish processing infrastructure, and a lack of capital to improve these areas. Continued investment by local and international organizations, as well as the Somali regional and federal governments, is crucial to upgrading buildings, roads, electrical systems, ports, and airports. There should be a significant increase in cold storage and ice-making capacity for the hygienic storage of catch and to obtain certification of facilities that will allow Somali seafood to be exported to global markets.[13] We offer additional suggestions in Box 4.2. Domestic funds for such work could be generated from revenue from licensing foreign vessels.

2.4 Develop new and comprehensive fisheries regulations that advance the goals for fisheries management established by Somali law. Somali Fisheries Law outlines broad goals for fisheries management, such as an optimum sustainable yield that accounts for environmental, economic, and social factors[m] and an ecosystem approach to setting total allowable catches (TAC).[n] These goals are important for designing management plans, engaging all stakeholders, balancing competing demands, and developing metrics for measuring management success. For example, when developing a management plan for areolate grouper (*Epinephelus areolatus*), measures could include: gear restrictions that protect grouper habitat, space restrictions that protect grouper spawning grounds, domestic license provisions that protect Somali fisher income, foreign license provisions that provide revenue for fisheries authorities, and TACs that account for the role of grouper in the ecosystem. While the new Somali Fisheries Law is a critical first step, comprehensive fisheries regulations are urgently needed. We recommend new fisheries regulations and management plans adhere to the principles defined by Somali Fisheries Law in Article 5. To ensure consistency between federal legislations and Somali regional fisheries legislations, these goals could be replicated at different levels of fisheries governance. Education and outreach programs about new regulations will inform fishers, traders, and exporters. Funds for such work could be generated from revenue from licensing foreign vessels.

j Somali Fisheries Law Article 5 §1 and §2, Article 25, Articles 33-37.

k Somali Fisheries Law Article 6, Article 7 §3 and §4, Article 9 §4, Article 23 §1 and §2.

l Somali Fisheries Law Article 3, Article 15, Article 16, Article 19, Article 30, Articles 38 and 39.

m Somali Fisheries Law Article 5 §1

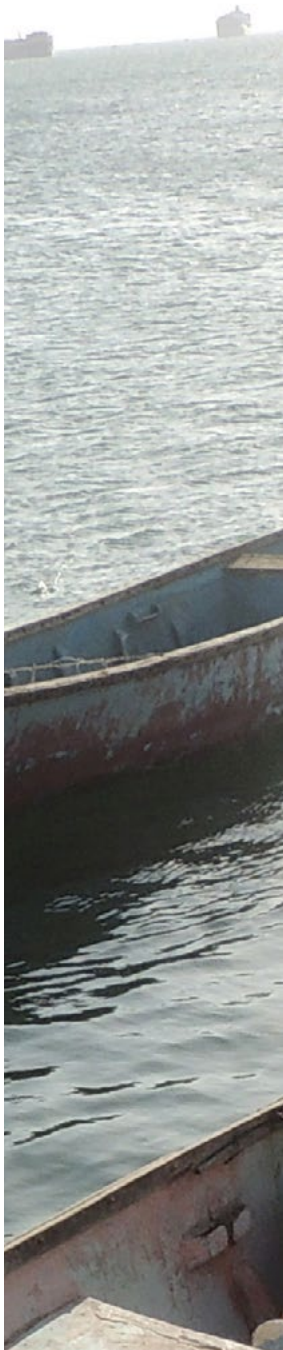
n Somali Fisheries Law Article 5 §2

2.5 Prioritize species or stocks for which management plans should be developed. The creation of new management plans will take time and collaboration, and it will likely be an iterative process. Prioritizing species based on current levels of catch (to reflect demand), potential revenue, and conservation status will create effective and sustainable management. Additionally, species at risk of being overfished should be prioritized even if current catch levels are moderate. Following our analysis in Chapters 3 and 4, we recommend the highest priority for HMS be given to yellowfin tuna, skipjack tuna, and bigeye tuna. These stocks are managed by the IOTC; therefore Somali authorities may want to collect data on their catch in Somali waters, ensure effective participation in the IOTC management process, and comply with IOTC CMMs. However, the other species of coastal tuna (such as kawakawa and longtail tuna) and billfishes should not be overlooked, as future harvest may grow and their conservation status may change accordingly. Further, we recommend the highest priority for management by the coastal regions be given to: pinkear emperor (*Lethrinus lentjan*), spangled emperor (*Lethrinus nebulosus*), areolate grouper (*Epinephelus areolatus*), painted sweetlips (*Diagramma pictum*), Indian oil sardine (*Sardinella longiceps*), green jobfish (*Aprion virescens*), flame snapper (*Etelis coruscans*), all species of spiny lobster (Palinuridae), cuttlefish and squid (Sepiidae, Loliginidae, and Onychoteuthidae), and penaeid shrimps (Penaeidae). Finally, given the urgent need for conservation measures for sharks and rays (see Box 3.2), especially shortfin mako (*Isurus oxyrinchus*), thresher sharks (*Alopias spp.*), and manta rays (Myliobatidae), we encourage Somali fisheries authorities to adopt measures in compliance with IOTC CMMs and expand their applicability to vessels under 24 m in length. Species of high commercial value are often prioritized over species that require conservation measures. We therefore recommend regular sustainability analyses, such as the data-poor panel regression model outlined in Chapter 4, to update the conservation status of fished stocks as needed.

2.6 Consider the implementation of Territorial Use Rights for Fisheries programs for coastal and demersal species. Territorial Use Rights for Fisheries (TURF) programs can be effective management tools in Somali regions threatened by unsustainable or IUU fishing and in areas where government resources are limited. TURFs are community-held rights of use and exclusion over the fishery resources within a specific area and for a period of time.[14] TURF management includes responsibilities for maintenance and proper management of the resource base, as well as restrictions on the exercise of the rights of use and exclusion. This approach has seen success because:[15]

- TURFs support locally appropriate decision-making by incorporating local science and community participation. Input from local fishers with a history of fishing in an area should be prioritized when regulations are developed, and new fishers should be allowed into a fishery when underutilized licenses are available.
- TURFs promote habitat and resource conservation by allocating specific marine areas to fishers, reducing competition and thus the incentive to "race to fish." This leaves fishers better equipped and more willing to develop and follow sustainable catch regulations.
- TURFs increase the income of artisanal fishers and support food security by reducing competition from outside fishers.
- TURFs do not require extensive government resources because they place management responsibility in the hands of local users.

We recommend the consideration of TURFs for coastal and demersal species that may be caught in multispecies assemblages and which should be managed from an ecosystem perspective. These would be most effective when implemented in coordination with federal management of highly migratory species. While TURFs provide opportunities for strong



local management, they require that exclusive rights be granted to a marine area in order to be effective. Exclusivity may help to ensure fisheries are well managed within artisanal fishing communities. However, such approaches require buy-in from all potential fishers to honor boundaries. This may be difficult to obtain from foreign fishers who may lack incentives to honor TURF agreements. An external authority or agreement may assist acknowledgement of TURF boundaries for both domestic and foreign vessels. Given the challenges Somalis face in preventing foreign vessels from entering and fishing in their waters, the success of a TURF may hinge on accompanying agreements from other fishing nations to honor the program.

Berbera harbor, Abdikarim Gole

2.7 Encourage coordination between federal and regional fisheries authorities in support of a unified Federal Somali Fisheries Authority. Many species migrate across Somali regional boundaries and throughout the Indian Ocean. Consequently, information sharing and management approaches, including issuance of fishing licenses for highly migratory species, should be encouraged between the regional as well as the federal ministries of fisheries by the establishment of a Federal Somali Fisheries Authority (FSFA). This Authority would manage Somali marine resources, help to implement Somali Fisheries Law and fisheries regulations, and implement management of HMS through data collection and participation in the IOTC. Progress has been made towards the development of the FSFA. In May 2014, at a meeting of the SMRSS in Addis Ababa, agreement was reached on modalities (including VMS requirements and HMS fishing zones) and revenue sharing from licensing between the FGS and coastal regions. The process later stalled over disagreement on the headquarters of the FSFA. Resumption of coordination meetings is needed to overcome disagreements and reinvigorate development of the FSFA.

2.8 Implement the provision of the Somali Fisheries Law that bans bottom trawling in Somali waters. The habitat destruction and bycatch caused by bottom trawling significantly damages marine resources and reduces overall fisheries productivity (see Chapter 2). Currently, foreign boats are responsible for most bottom trawling.[o] The Somali Fisheries Law expressly bans bottom trawling,[p] and this should help bottom habitat recover and reduce bycatch of non-target species. There is likely to be resistance or refusal by foreign vessels to abide by these gear restrictions. We encourage Somali authorities across all Somali regions to maintain these provisions in the face of outside pressure. We further encourage the international community to respect these gear restrictions for the benefit of Somali coastal habitats, its people, and their

o But see discussion in Chapter 2 about South Korean trawlers that recently re-flagged to Somalia.

p Article 33

livelihoods. Foreign nations fishing in Somali waters should help enforce this ban by carefully tracking their own fleets and imposing harsh consequences for violations. Such regulations will ultimately require a strong Somali Coast Guard for patrol and enforcement.

GOAL 3. AN INTERNATIONAL CALL TO ACTION TO STOP ILLEGAL AND DESTRUCTIVE FOREIGN FISHING

The sustainable harvest of living marine resources is critical to economic prosperity in Somali waters. Yet foreign fishing vessels have encroached on Somali waters for years, harvesting over one million metric tons of fish in the last decade, destroying habitats, and harming the ecological balance of the marine environment. The consequences of IUU fishing by foreign boats are profound and could harm the Somali artisanal fisheries sector—a potential economic engine—for years to come.

We call upon the international community to take responsibility for and work with Somalis to stop IUU fishing by foreign boats, and to criminalize the actions of distant water fleets that operate in unprotected marine environments like Somalia's EEZ. We also call upon the international community to help the Somali effort to track the presence of foreign vessels within their EEZ through the sharing of real-time AIS and VMS data and information gathered from all domestic patrol boats and navies that operate in or near Somali maritime boundaries. These data should include the corresponding dates, locations, sizes, and flag-states of all foreign fishing vessels observed and the type of gear deployed. Additionally, Secure Fisheries urges the international community to:

3.1 Require flag-states to compel registered vessels to comply with Somali legislation and enforce sanctions when violated. Somali Fisheries Law lays out clear avenues for licensing of foreign vessels, restrictions against bottom trawlers, reporting requirements, and conservation measures. The international community must compel their vessels to immediately abide by these laws.

3.2 Support data and information sharing initiatives and identify vessels fishing in Somali waters without licenses or using destructive fishing practices. In response to Somali pirate activity, the international community created mechanisms to increase maritime domain awareness in the Western Indian Ocean. For example, the European Union Naval Force ATALANTA regularly patrols Somalia's EEZ to ensure the safety and security of merchant vessels, deter and disrupt armed robbery at sea, and monitor fishing activities off the coast of Somalia. However, information gathered while monitoring fishing activities has not been shared with the Somali government, and it should be. Moreover, the nature of these fisheries data and how they are used within ATALANTA is unclear. Secure Fisheries recommends that the European Union Naval Force work with the federal and regional governments of Somalia to disseminate information on foreign fishing activities in order to prosecute illegal foreign fishing vessels. A successful information sharing group in Africa, FISH-i Africa, could be another important mechanism of information sharing for Somalis to join. FISH-i Africa, launched in the Seychelles in December 2012, is a partnership uniting seven southeast African coastal states along the Western Indian Ocean in an effort to stop IUU fishing. Utilizing inter-state cooperation, real-time vessel tracking, and shared data analysis and intelligence, FISH-i Africa enables authorities to identify and act against large-scale IUU fishing. Somalia is not currently a member, but discussions to include it going forward have occurred. We recommend that Somali fisheries agencies and FISH-i Africa continue to work together toward the inclusion of Somalia in this partnership.

> ***The situation is catastrophic and disastrous. [Foreign fishers] are leaving no fish in the ocean. Something must be done about this. Puntland Administration should be helped in establishing coast guard troops to protect the ocean.***
>
> **Fisher from Bosaso**

3.3 Increase import restrictions on IUU fish. Recently, the European Union increased efforts to stem the tide of IUU fish entering their domestic marketplaces. Only marine fisheries products validated as legally caught by a competent flag-state or exporting state can be imported to the EU. There are established

pathways for classifying a flag-state or exporting state as a non-cooperating third country in fighting IUU fishing, thereby blocking further imports from such countries. However, seafood caught in Somali waters is known to enter the EU marketplace, and we therefore recommend that the EU Parliament Fisheries Committee and the Directorate-General for Maritime Affairs and Fisheries work with relevant Somali agencies to identify and take action against foreign-flagged IUU vessels operating in Somalia's EEZ and to refuse these imports. Further, we urge other nations to follow the EU's lead in enacting such import restrictions.

3.4 Enforce inspections of all vessels fishing in Somali waters but landing catch outside Somalia. This report details a significant number of foreign fishing vessels of dubious legality presently operating in Somali waters. These vessels exclusively land their catch outside of Somalia in, for example, the Seychelles, Oman, Yemen, Djibouti, or Kenya. We recommend Somali federal and regional governments and international partners work together to gather intelligence for prosecution and partner with relevant port states to enforce Somali fisheries legislation in order to minimize the flow of illegal Somali fish to distant ports. The PSMA, outlined above, is an important step in eliminating ports of convenience that serve as safe havens for IUU vessels and allow illegal products to enter the global supply chain. Therefore, we further recommend that all Indian Ocean countries ratify the PSMA. We commend the Seychelles, Oman, Mozambique, and Sri Lanka for joining nine other nations and the EU in ratifying the agreement.[q]

3.5 Hold owners responsible for the actions of their vessels, even if flagged to a different nation. IUU vessels can escape fines and other punishments by changing the flags of their vessels from those of cooperating nations to flags of convenience (see Box 2.2). As a consequence, vessel owners are able to distance themselves from the actions of their vessels and avoid legal blame for IUU fishing. Following the example of South Korea,[16] we call for all nations to enact restrictions against vessels fishing in waters without proper fisheries management and control systems, even if those ships re-flag to another nation. We also call on South Korea to enforce their newly amended Distant Water Fisheries Development (DWFD) Act and prosecute the South Korean owners of the fishing vessels operating in Somali waters.

Berbera fisherman, Jean-Pierre Larroque

The presence of trawlers formerly flagged to Korea in Somali waters presents a test case for this recent amendment of the DWFD Act. Korea must build on its newly adopted role to become a responsible global leader and investigate IUU fishing off the coast of Somalia and prosecute and convict Korean nationals if legal violations are proven.

3.6 Support Indian Ocean regional agreements to end IUU fishing throughout the Indian Ocean that:

- *Increase the use of AIS on fishing vessels to achieve parity with merchant ships.* Automatic Identification Systems (AIS) broadcast a vessel's identity, position, and other information to nearby vessels, coastal tracking stations, and low-orbiting commercial satellites that provide global AIS tracking. Under the International Convention for the Safety of

q Nations ratifying the PSMA as of August 19, 2015.

Life at Sea, all commercial vessels larger than 300 gross tons must use AIS, which is critical to safety and security at sea. However, AIS is not mandatory for fishing vessels unless a coastal nation requires it for ships under its jurisdiction. In order for port state measures to be an effective enforcement and deterrent mechanism for illegal fishing, the use of AIS on fishing vessels must achieve parity with its use on merchant ships.

- *Strengthen the regional coordination of law enforcement and prosecutorial actions against fisheries crime.* To do so, nations must recognize the links between fishing crime and transnational organized crime and introduce comprehensive legislation to combat maritime crimes in a holistic way.

- *Adopt mandatory, unique, and permanent ship identification numbers in accordance with the standards of the International Maritime Organization (IMO) to better identify fishing vessels and ensure accountability.* Unlike merchant vessels, fishing vessels are not required to have unique identifying numbers that remain from construction to scrapping. Although fishing vessels have names, call signs for radio transmissions, and other identifiers, these are not permanent and can be changed quickly and easily (see Box 2.2). This lack of unique and permanent identification makes it difficult for authorities to distinguish specific vessels engaged in IUU fishing and to gather evidence when they suspect unlawful activity. As a result, vessel owners can evade control measures and continue to fish without being traced, even if they are already blacklisted for IUU fishing. These illegal vessels can operate for years without accurate records of their activities, operating condition, or compliance status. Requiring mandatory, unique, and permanent ship identification numbers in accordance with the standards of the IMO would be a significant step towards reducing this risk and combating IUU fishing. In 2014, the IOTC took steps[17] in this direction by requiring vessels on the IOTC Record to have IMO numbers. Such a requirement should be extended to vessels fishing for species besides tuna and tuna-like fishes.

REFERENCES

1 Somali Maritime Resource & Security Strategy Fisheries Working Group. (2014, April 6). Communique of the Somali MRSS Fisheries Working Group. Beau Vallon, Seychelles. Retrieved from http://oceansbeyondpiracy.org/sites/default/files/attachments/Apr%206%20Somali%20Fisheries%20Working%20Group%20Communique_0.pdf

2 Indian Ocean Tuna Commission. (2014). Somalia joins the IOTC July 2014. Retrieved from http://www.iotc.org/news/somalia-joins-iotc-july-2014

3 UN General Assembly. (2014, July 3). *Convention on the Law of the Sea* (Maritime Zone Notification M.Z.N.106.2014.LOS). Retrieved from http://oceansbeyondpiracy.org/sites/default/files/attachments/Somali%20EEZ%20Declaration.pdf

4 Somali Maritime Resource & Security Strategy Fisheries Working Group, 2014 Communique

5 Ibid.

6 Ibid.

7 Port State Measures Agreement. FAO. Retrieved from http://www.fao.org/fishery/topic/166283/en.

8 Somali Maritime Resource & Security Strategy Fisheries Working Group, 2014 Communique

9 Indian Ocean Tuna Commission. (2015, April 27). Report on presumed IUU fishing activities in the EEZ of Somalia. Retrieved from http://www.iotc.org/documents/report-presumed-iuu-fishing-activities-eez-somalia

10 African Development Solutions. (2015). Illegal Unreported and Unregulated (IUU) Fishing in the Territorial Waters of Somalia. Nairobi, Kenya.

11 Ibid.

12 Ibid.

13 Ministry of Trade and Investment, Somaliland. (2014). An investment guide to Somaliland opportunities and conditions. (2014). Retrieved from http://somalilandinvest.net/somaliland_investment_guide.pdf.

14 Panayotou, T. (1982). Territorial Use Rights in Fisheries. Preliminary report. Rome, 6–9 December. Retrieved from http://www.fao.org/3/a-ac749e/AC749E12.htm.

15 Environmental Defense Fund Fishery Solutions Center. Territorial Use Rights for Fishing (TURF) Programs. Retrieved from http://fisherysolutionscenter.edf.org/catch-share-basics/turfs.

16 Environmental Justice Foundation. (2015, April 21). EU removes South Korea from list of those failing to combat pirate fishing. Retrieved from http://ejfoundation.org/news/eu-removes-south-korea-list-those-failing-combat-pirate-fishing.

17 Indian Ocean Tuna Commission. (2013, November 13). Resolution 14/05 Concerning a record of licensed foreign vessels fishing for IOTC species in the IOTC area of competence and access agreement information. Retrieved from http://www.iotc.org/cmm/resolution-1307-concerning-record-licensed-foreign-vessels-fishing-iotc-species-iotc-area

GLOSSARY

Beach seine
A seine net (see definition below) usually hand-deployed by affixing one side of the net to the shore and pulling the free side through the water in a semi-circle to surround fish and invertebrates. This is a non-selective fishing method that catches any animals encountered that are larger than the net mesh size.

Bathymetry
The elevations and slopes of lake or ocean floors. The equivalent of topography on land.

Benthic
Associated with the deepest level of a body of water including the bottom sediment surface and sub-surface layers.

Benthivore
An animal that primarily consumes bottom-dwelling species.

Bottom trawling
A method of fishing whereby a cone-shaped net is dragged by a boat along the seafloor. The mouth of the net is held open by a top float line, a weighted line that makes contact with the bottom sediment, and two lateral wings with doors (solid flat panels) held apart by the movement of the net through the water. This is a non-selective fishing method catching any animals on or near the bottom that are larger than the net mesh size.

Bycatch
Unwanted or non-target fish or other animals caught during fishing.

Cast net
A circular net with weights around the edges that is thrown onto the surface of the water such that it spreads out and then sinks over the fish in the water column underneath it. When the net is hauled in by an attached rope, it ensnares the fish.

Cephalopods
Soft-bodied marine mollusks including squid, cuttlefish, and octopus.

Conservation and Management Measures
Binding resolutions or voluntary recommendations adopted at sessions of the Indian Ocean Tuna Commission that concern management of tuna and tuna-like species under the IOTC mandate.

Cooperative
An association of people who work together for their mutual economic benefit.

Demersal
At or near the bottom of a body of water. Above, but associated with, the benthos.

Dhow
Generic term for many types of traditional sailing vessels in the Indian Ocean with one or more masts with triangular sails. They are often made of wood and can be used as fishing vessels or for the transportation of goods. Modern dhows are often equipped with engines.

Door tracks
Gouges made in the bottom sediment by the doors of a trawl during fishing.

Driftnet
A fishing net kept vertical in the water column by floats at the top and weights at the bottom, similar to a gillnet, but allowed to drift with the tide or current. It is a non-selective method that relies on entanglement to catch fish and any other animal that encounters it.

Epipelagic
Associated with the uppermost oceanic zone into which enough light penetrates for photosynthesis to occur, generally from the surface down to 200 m.

Ex-vessel price
The price paid for fish, usually per unit weight, at the first point of sale. This frequently refers to the price obtained at the beach or directly from the vessel.

Fishery production potential (FPP)
The total biomass of marine life that can be extracted on an annual basis from a given area when economic (feasibility) and ecological (sustainability) considerations are made.

Fishmonger
A person who sells fish to be eaten.

Forage fish
Small schooling fishes that feed on plankton and are eaten by larger predators. They compose the middle of the food chain between primary producers and top predators.

Gillnet
A fishing net kept vertical in the water column by floats on or near the surface and weights on the bottom, usually set in a straight line. Fish are captured by being wedged in the net mesh, held by the net mesh slipping behind their gill coverings, or entangled in the net by their fins, spines or teeth. Other animals may also be entangled in this way. The captured fish often attract predators like sharks which may also become entangled. Gillnets can be anchored to the sea bottom or to a boat, or they can be allowed to drift (see driftnet). This is a common fishing method used in Somali waters by Somalis and foreign fishers and is a non-selective method, catching any fish or animal that encounters it.

Handline
A type of fishing gear whereby a baited hook or lure is attached to a line that is held in the hands of the fisher. This method can target certain species of fish through the choice of deployment location or type of bait and is often used by Somali fishers.

IUU fishing
Illegal, unreported, and unregulated fishing is fishing that is conducted in violation of legal conservation and management measures. See the text of Chapter 2 in this report for a full definition.

Jig
A fishing lure that is made to look like a soft-bodied animal and weighted so that when it is jerked in the water, it moves vertically and has a realistic appearance to attract predators, especially squid.

Landings
The amount of marine life harvested from the sea and brought to land for consumption. Volume of landings is often the amount actually caught at sea minus any discards or other waste.

Longline
A type of fishing gear composed of a long main line with many shorter lines hanging from it at intervals, each ending with a baited hook. The main line has floats so it remains near the surface. It is often used for catching tuna, mackerel, billfish, and sharks.

Macroalgae
Large marine plant-like algae, commonly known as seaweed.

Maximum sustainable yield (MSY)
The largest catch that can be taken over the long term without causing a population to collapse.

Mesopelagic
Associated with the middle layer of the open ocean (pelagic zone), where little light penetrates. It is sometimes called the "twilight zone" because it is between the zone where light penetrates and the totally dark layer below it.

Monsoon
Seasonal reversal of wind direction accompanied by corresponding changes in precipitation due to the uneven heating of the land versus the sea.

Optimum sustainable yield (OSY)
The level of fishing effort that maximizes the difference between total revenue and total cost.

Pelagic
Relating to or living in the open ocean, away from coasts and land masses.

Piscivore
An animal that primarily eats fish. These are generally top predators, such as tuna.

Planktivore
An animal that primarily eats zooplankton or phytoplankton. They are generally consumed by higher-order predators.

Pole and line
A method of fishing using a pole with a line attached to it and a hook on the end. Often used commercially in the Indian Ocean to catch tuna.

Purse seine
A large wall of netting deployed by boat around an entire school of fish. The net has a float line at the top and is threaded through rings at the bottom so that when the bottom line is pulled, the bottom of the net closes, trapping the fish. It is commonly used to capture small and large pelagic schooling fish such as sardines and tuna.

Reefer truck
A refrigerated truck used for the storage and transport of fish and fish products.

School
A large number of fish swimming together.

Seine
A fishing net that hangs vertically in the water with a floated line at the water's surface and a weighted line on the bottom. They can be deployed from the shore by hand or in deeper water by boat.

Stakenet
A type of fishing net consisting of stakes driven into the sea bottom near the coast with nets hung in between as walls or pens with entrances for fish to swim into.

Substrate
The earthy material, such as mud, sand, or gravel, composing the bottom of a body of water.

Territorial waters
Defined by the 1982 United Nations Convention on the Law of the Sea as the waters of a coastal nation extending from shore out to 12 nautical miles (22 km). Also called territorial sea. The country to which the territorial waters belong maintains sovereign rights over this zone and the resources within it.

Top predator
An animal that occupies the top of the food chain and has no predators of its own.

Total allowable catch (TAC)
A regulatory limit on the amount of catch that can be taken from a specific fish stock.

Transshipment
The process of transferring items, such as fish, from one vessel to another at sea. Commonly, smaller fishing vessels transfer catch onto a larger vessel (sometimes referred to as a mothership), often with freezing capabilities and much larger amounts of storage. The mothership may collect catch from many smaller ships and then return to a port for landing. Transshipment may be legal in many contexts, but it also can be used to avoid reporting catch to authorities or to facilitate smuggling. Transshipment of fish catch may be problematic when done by foreign vessels because the host country is unable to collect fees or inspect landings if they are not brought into port.

Trap
A method of fishing for crustaceans or fish using a cage made of wire, wood, or net that is constructed so fish or invertebrates can easily get in but cannot get out. It is sometimes baited to attract a target species.

Trawl
A net that is pulled behind a boat to catch fish. The net mouth (opening) consists of doors or solid panels to hold the net open while under way, a weighted line that scrapes or rolls on rollers across the bottom, a line with floats to keep the net open vertically. The net is tapered to the end and attains a funnel shape while fishing.

Trawling
A method of fishing involving pulling a net behind one or more boats, catching all the animals in its path that are larger than the net mesh size. It is a non-selective fishing method and can be done on the sea bottom, in the middle of the water column, or on the surface.

Trolling
A method of fishing that involves dragging a baited hook or lure on a line through the water, usually behind a boat. It is used to catch pelagic fish such as tuna, mackerel, and billfish.

UNCLOS
The 1982 United Nations Convention on the Law of the Sea is a legal mechanism for creating a global regime for governance of nations' coastal waters and resources.

Upwelling
Upwelling is an oceanographic process that occurs when wind blows across the ocean surface from land to water, pushing the surface water away from the land and allowing cold, nutrient-rich waters at depth to come to the surface. The high nutrient levels promote high productivity where upwelling occurs.

Value chain The series of processes or activities by which people or companies add value to a product.

SECURE FISHERIES

Advancing Sustainable Fisheries

www.securefisheries.org

Secure Fisheries is a program of the One Earth Future Foundation

one earth FUTURE

www.oneearthfuture.org