



MSB FMP Goals/Objectives and *Illex* Permits Amendment

Public Hearing Document

March-April 2020



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<http://www.mafmc.org/actions/illex-permitting-msb-goals-amendment>

How to Provide Comments

Written comments should be submitted by 11:59 pm on April 20, 2020 through one of the following methods with the subject “MSB Goals and *Illex* Permits”:

- **Email** to Jason Didden: jdidden@mafmc.org
- Through an **online form** at: <http://www.mafmc.org/comments/illex-permitting-msb-goals-amendment>
- **Mail** to Dr. Chris Moore, Executive Director, Mid-Atlantic Fishery Management Council, 800 North State Street, Suite 201, Dover, DE, 19901
- **Fax** to Dr. Chris Moore, Executive Director, Mid-Atlantic Fishery Management Council at 302-674-5399
- **Hearings**, listed below

Hearings – Due to public health concerns, hearings have been switched to webinars.

Please contact Jason Didden at jdidden@mafmc.org or (302) 526-5254 if you would like to test your ability to connect to the webinar. Telephone instructions are provided upon connecting, or you can call direct: 800-832-0736, Rm: 7833942#. You can listen-in using the link, but you must call in by phone to participate.

Date and Time	Location
Monday March 30, 2020, 6 p.m.	http://mafmc.adobeconnect.com/msb-illex-2020/
Tuesday March 31, 2020, 6 p.m.	http://mafmc.adobeconnect.com/msb-illex-2020/
Wednesday April 1, 2020, 6 p.m.	http://mafmc.adobeconnect.com/msb-illex-2020/
Thursday April 2, 2020, 6 p.m.	http://mafmc.adobeconnect.com/msb-illex-2020/
Monday April 13, 2020, 6 p.m.	http://mafmc.adobeconnect.com/msb-illex-2020/

A video presentation for this action will also be recorded and linked at <http://www.mafmc.org/actions/illex-permitting-msb-goals-amendment> by March 21, 2020.

1. Overview, Tables of Contents, and Acronyms

Overview

This amendment to the Atlantic Mackerel, Squid, and Butterfish Fishery Management Plan (MSB FMP) considers revisions to the MSB goals and objectives and modifications to *Illex illecebrosus* squid (simply “*Illex*” hereafter) fishery permitting, plus related management measures.

The goals and objectives revisions are addressed in the introduction section and are not treated as alternatives per se (similar to the chub mackerel amendment). The Mid-Atlantic Fishery Management Council (Council) seeks to ensure that the MSB goals and objectives align with the Council’s current vision and priorities. Related to *Illex* permitting, the Council is evaluating effort in the *Illex* squid fishery, which closed early in 2017-2019 after reaching its quota. The majority of annual landings have been harvested by a relatively small portion of permitted vessels, and the Council is responding to concerns from some fishery participants that recent and/or future activation of latent effort/permits could exacerbate a race to fish and associated negative outcomes. Accordingly, the objectives of this action are to A) consider revising the overall MSB goals and objectives and B) consider the appropriate number of permits and related management measures in the *Illex* fishery, and reduce the number of directed permits if appropriate.

After reviewing Fishery Management Action Team (FMAT), Advisory Panel, and other public recommendations, the Council developed a range of alternatives and associated analyses described in this document. The Council will select final preferred alternatives after considering comments received during public hearings, written comments, and comments at relevant Council meetings. The Council can modify the alternatives before final action provided there is sufficient rationale for such modification. Final Council action is planned for June 2020.

If the Council recommends some action alternatives, NOAA Fisheries will then publish a proposed rule along with an Environmental Assessment for public comment. After considering public comments on the proposed rule NOAA fisheries will determine the approvability of the measures. If action is approved, NOAA Fisheries will publish a final rule that will include implementation details.

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Acronyms and Other Wording Conventions

ABC	Acceptable Biological Catch
Council	Mid-Atlantic Fishery Management Council
EAFM	Ecosystem Approach to Fisheries Management
FMAT	Fishery Management Action Team
FMP	Fishery Management Plan
MAFMC	Mid-Atlantic Fishery Management Council
MRI ¹	moratorium right identification
MSB	Mackerel, Squid, and Butterfish
MT	Metric Tons (1 metric ton = 2,204.62 pounds)
NEFSC	Northeast Fisheries Science Center
NMFS	National Marine Fisheries Service
VMS	Vessel Monitoring System
VTR	Vessel Trip Report

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¹ The term MRI or “moratorium right identification” may be a new term for some people. An MRI number tracks fishing history of a limited access permit even if it moves between vessels.

2. Introduction

This amendment to the Atlantic Mackerel, Squid, and Butterfish (MSB) Fishery Management Plan (FMP) considers A) revisions to the MSB FMP goals and objectives and B) modifications to *Illex* fishery permitting and related management measures. The Council is seeking public input on all aspects of this action. No preferred alternatives have been identified at this time. Data and preliminary analyses are based on standard databases (dealer data, Vessel Trip Report (VTR) data, observer data, permit data, etc.).

A) MSB FMP Goals and Objectives

The Council identified review of FMP goals and objectives via strategic planning in order to ensure that FMP goals and objectives remain relevant. The current MSB objectives have not been reviewed since the merged MSB plan was adopted in 1981. The Magnuson–Stevens Fishery Conservation and Management Act (“Magnuson-Stevens Act”) has been amended several times since then, and the Council has also since adopted two Strategic Plans and an Ecosystem Approach to Fisheries Management (EAFM) Guidance Document (<http://www.mafmc.org/eafm>). Chub mackerel were also added to the FMP with specific goals and objectives that were informed by the EAFM Guidance Document. The EAFM goal is to manage for ecologically sustainable utilization of living marine resources while maintaining ecosystem productivity, structure, and function.

The goals and objectives are not alternatives in the traditional sense, but generally inform decision making, so the existing and potentially new goals and objectives are reviewed in this section rather than in the alternative section.

The current MSB FMP objectives are:

1. Enhance the probability of successful (i.e., the historical average) recruitment to the fisheries.
2. Promote the growth of the U.S. commercial fishery, including the fishery for export.
3. Provide the greatest degree of freedom and flexibility to all harvesters of these resources consistent with the attainment of the other objectives of this FMP.
4. Provide marine recreational fishing opportunities, recognizing the contribution of recreational fishing to the national economy.
5. Increase understanding of the conditions of the stocks and fisheries.
6. Minimize harvesting conflicts among U.S. commercial, U.S. recreational, and foreign fishermen.

The Council recently adopted goals and objectives for managing chub mackerel within the MSB FMP:

Goal 1: Maintain a sustainable chub mackerel stock.

Objective 1.1: Prevent overfishing and achieve and maintain sustainable biomass levels that achieve optimum yield in the fisheries and meet the needs of chub mackerel predators.

Objective 1.2: Consider and account for, to the extent practicable, the role of chub mackerel in the ecosystem, including its role as prey, as a predator, and as food for humans.

Goal 2: Optimize economic and social benefits from utilization of chub mackerel, balancing the needs and priorities of different user groups.

Objective 2.1: Allow opportunities for commercial and recreational chub mackerel fishing, considering the opportunistic nature of the fisheries, changes in availability that may result from changes in climate and other factors, and the need for operational flexibility.

Objective 2.2: To the extent practicable, minimize additional limiting restrictions on the *Illex* squid fishery.

Objective 2.3: Balance social and economic needs of various sectors of the chub mackerel fisheries (e.g. commercial, recreational, regional) and other fisheries, including recreational fisheries for highly migratory species.

Goal 3: Support science, monitoring, and data collection to enhance effective management of chub mackerel fisheries.

Objective 3.1: Improve data collection to better understand the status of the chub mackerel stock, the role of chub mackerel in the ecosystem, and the biological, ecological, and socioeconomic impacts of management measures, including impacts to other fisheries.

Objective 3.2: Promote opportunities for industry collaboration on research.

Unified Goals and Objectives

Over the course of several meetings the Council, with input from the FMAT and AP, melded the above two sets of goals/objectives into a single unified goals and objectives that can apply to the entire FMP:

Goal 1: Maintain sustainable MSB stocks.

Objective 1.1: Prevent overfishing and maintain sustainable biomass levels that achieve optimum yield in the MSB fisheries.

Objective 1.2: Consider and, to the extent practicable, account for the roles of MSB species/fisheries in the ecosystem.

Goal 2: Acknowledging the difficulty in quantifying all costs and benefits, achieve the greatest overall net benefit to the Nation, balancing the needs and priorities of different user groups and effects of management on fishing communities.

Objective 2.1: Provide the greatest degree of freedom and flexibility to harvesters and processors (including shoreside infrastructure) of MSB resources consistent with attainment of the other objectives of this FMP, including minimizing additional restrictions.

Objective 2.2: Allow opportunities for commercial and recreational MSB fishing, considering the opportunistic nature of the fisheries, changes in availability that may result from changes in climate and other factors, and the need for operational flexibility.

Objective 2.3: Consider and strive to balance the social and economic needs of various sectors of the MSB fisheries (commercial including shoreside infrastructure and recreational) as well as other fisheries or concerns that may be ecologically linked to MSB fisheries.

Objective 2.4: Investigate opportunities to access international/shared resources of MSB species.

Goal 3: Support science, monitoring, and data collection to enhance effective management of MSB fisheries.

Objective 3.1: Improve data collection to better understand the status of MSB stocks, the role of MSB species in the ecosystem, and the biological, ecological, and socioeconomic impacts of management measures, including impacts to other fisheries.

Objective 3.2: Promote opportunities for industry collaboration on research.

Objective 3.3: Encourage research that may lead to practicable opportunities to further reduce bycatch in the MSB fisheries.

B) Modifications to Illex Fishery Permitting and Related Management Measures

As discretionary provisions of FMPs, the Magnuson-Stevens Act states that any FMP may establish a limited access system for the fishery in order to achieve optimum yield if, in developing such system, the Council and the Secretary take into account:

- (A) present participation in the fishery;
- (B) historical fishing practices in, and dependence on, the fishery;
- (C) the economics of the fishery;
- (D) the capability of fishing vessels used in the fishery to engage in other fisheries;
- (E) the cultural and social framework relevant to the fishery and any affected fishing communities;
- (F) the fair and equitable distribution of access privileges in the fishery; and
- (G) any other relevant considerations.

The Council must also take into account the Magnuson-Stevens Act's ten national standards during all decisions (<https://www.fisheries.noaa.gov/national/laws-and-policies/national-standard-guidelines>). National Standards 4, 5, 6, and 8 are particularly relevant to this action:

National Standard 4 - Conservation and management measures shall not discriminate between residents of different states. If it becomes necessary to allocate or assign fishing privileges among various United States fishermen, such allocation shall be (a) fair and equitable to all such fishermen; (b) reasonably calculated to promote conservation; and (c) carried out in such manner that no particular individual, corporation, or other entity acquires an excessive share of such privilege.

National Standard 5 - Conservation and management measures shall, where practicable, consider efficiency in the utilization of fishery resources; except that no such measure shall have economic allocation as its sole purpose.

National Standard 6 - Conservation and management measures shall take into account and allow for variations among, and contingencies in, fisheries, fishery resources, and catches.

National Standard 8 - Conservation and management measures shall, consistent with the conservation requirements of this Act (including the prevention of overfishing and rebuilding of overfished stocks), take into account the importance of fishery resources to fishing communities by utilizing economic and social data... in order to (a) provide for the sustained participation of such communities, and (b) to the extent practicable, minimize adverse economic impacts on such communities.

Some fishery participants requested that the Council consider modifying limited access *Illex* permits to reduce the number of directed permits in the fishery given the increasing participation and early closure in 2017, which was repeated in 2018 and 2019. While the *Illex* fishery had only landed more than 75% of its quota three times between 2000 and 2016, the majority of annual landings (including 2017-2019) have been harvested by a relatively small portion of permitted vessels. The Council is responding to concerns from some fishery participants that recent and/or future activation of latent effort/permits could exacerbate racing to fish. With racing to fish, fishery participants typically use more and more capital and/or effort in an increasingly rushed attempt to catch a limited quota before closure. Capital continues to enter the fishery if there are any profits, increasing costs until profits are dissipated, creating a loss of efficiency (see Warming 1911 and Gordon 1954 for some of the first of many discussions of this phenomena). Besides tending to erode profits from the fishery overall, racing to fish can cause a number of other negative outcomes that the Council is considering including²:

-Safety at sea: Racing to fish may lead to taking more risks related to weather, maintenance and overloading (e.g. see NRC 1991 and FAO 2016 for reviews of related literature as well as Pfeiffer and Gratz 2016).

-Monitoring difficulties: Higher weekly landings make it more difficult to close the fishery near the quota (at least without adding reporting burden or setting aside more quota for larger closure buffers). The quota was exceeded by about 5% in 2018 and 9% in 2019.

-Business disruptions: More rapid catch by additional vessels could lead to shorter seasons for vessels that have been historically dependent on *Illex*. The fishery can operate into October or November but closed in August in 2018 and 2019, and in September in 2017.

-Yield reduction: Catching the quota earlier may mean that smaller squid are harvested, which means that more individuals are harvested per metric ton, which may reduce yield per recruit and total yield given the fast-growing nature of *Illex* (NAFO 1978, NEFSC 1999).

-Community impacts: The Council is also concerned about disruptions in communities if new entrants rapidly change the distribution of landings at relevant ports in communities that have dependence on *Illex*.

These issues would not be completely solved by reducing permits in the *Illex* fishery. Solving the race to fish is generally very challenging with quota-based management unless individual quotas or effort controls are utilized. Based on public scoping comments that were predominantly opposed to individual quotas, the Council is not considering individual quotas at this time. Given the variability in *Illex* productivity and availability, the Council believes that effort controls are not appropriate for the primary

² While bycatch can be exacerbated by racing to fish, bycatch is not currently a substantial issue for the *Illex* fishery.

directed fishery. However, the Council believes that given the latent permits that have existed in this fishery and recent effort levels, reducing the number of permits may be appropriate at this time in order to at least slow the worsening of the race to fish in the *Illex* fishery. So one purpose of this action is to mitigate worsening of the race to fish by considering reducing the number of permits that have unlimited access to the fishery.

In 2019, landings by the top 20 vessels (out of 76 potential permits³), accounted for 90% of the landings, and ranged from approximately 7.3 to 0.8 million pounds, with a median of 1.6 million pounds. The season lasted approximately 14 weeks, so the top vessel averaged around 0.52 million pounds per week and the median vessel (out of the top 20) averaged 0.12 million pounds per week. Based on this information, five less active vessels performing like the top vessel for 10 weeks could thus land nearly 26 million pounds, or 47% of the quota. Five less active vessels performing like the median of the top 20 vessels for 10 weeks could likewise land nearly 6 million pounds, or 11% of the quota. While it's not possible to know how vessels may participate in the future or at what level, it does appear that increased catch by even a handful of formerly latent/less active participants could have a substantial impact on racing to fish and how soon the fishery closes at the current quota.

3. *Illex* Life History and Status of the Stock

Illex squid is a benthopelagic schooling species distributed between Newfoundland and the Florida Straits. Current research indicates they live less than one year but several aspects of their life cycle are unknown due to their generally offshore habitat. Spawning is believed to take place in the water column with pelagic egg masses. *Illex* squid prey mostly on crustaceans at small sizes but increasingly prey on fish as they grow larger. Cannibalism of small squid by larger squid is especially prevalent during fall. A wide variety of fish (including large pelagics), seabirds, and marine mammals are predators of *Illex* squid. Additional life history information is detailed in the EFH document for the species, located at: <http://www.nefsc.noaa.gov/nefsc/habitat/efh/>. The current stock status of *Illex* is unknown with respect to either stock biomass or fishing mortality, due to the fact that the data necessary for assessing this species, given its short lifespan, is lacking and productivity of the resource is uncertain. The current acceptable biological catch (ABC) (26,000 metric tons (MT) or 57.3 million pounds) resulted from a generally qualitative evaluation by the Council's Scientific and Statistical Committee (SSC) that determined catches associated with an ABC up to 26,000 MT are unlikely to cause overfishing. More details on the rationale for the current ABC are available at: <http://www.mafmc.org/ssc-meetings/2018/sept-11>.

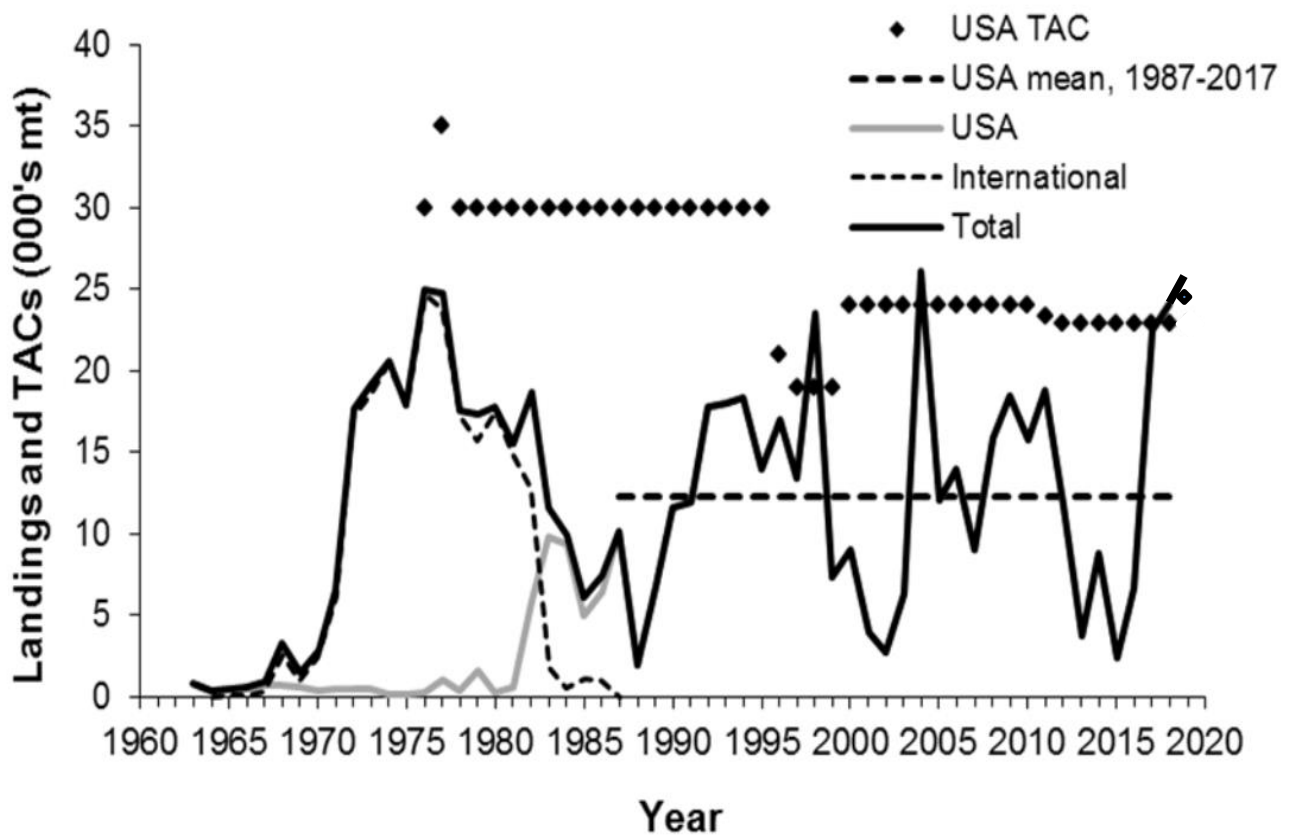
The Council has also established a working group (<http://www.mafmc.org/actions/illex-working-group>) to investigate if current information suggests that adjustments to the *Illex* quota are appropriate, and if there are ways to make the quota more responsive to real-time conditions. There is also a benchmark *Illex* assessment planned for 2021. At this time, the outcome of these endeavors is uncertain. Some short-term results of the workgroup will likely be known by June 2020 and may influence SSC discussions regarding short-term ABCs, but there are also longer-term tasks that may be in progress beyond 2020.

³ There were 76 *Illex* permits as of late 2019, but this number can change (shrink) if a permit is relinquished.

4. U.S. *Illex* Fisheries and Communities

International jig and trawler fleets initially fished *Illex* in U.S. waters, ramping up quickly in the 1970s to about 20,000-25,000 metric tons (MT) (52.9-55.1 million pounds) annually before being phased out by 1987. Development of the domestic *Illex* squid bottom trawl fishery began in the early 1980s as the U.S. industry developed the appropriate technology to catch and process squid in large quantities. Domestic landings have been highly variable (see Figure 1). The 2019 *Illex* landings were the highest on record, over 27,100 MT (the quota was exceeded by about 9%).

Figure 1. Landings and Quotas (TAC) (000's mt) of *Illex* from NAFO Subareas 5+6, by fleet during 1963-2019.



Annual *Illex* ex-revenues (Figure 2, red-dashed line) are determined by the combination of availability, global and domestic squid prices, and the resulting landings. Ex-vessel values during 2017-2019 were the three highest points in the time series due to the combination of high landings and high prices (see Figures 2 and 3). 2019 ex-vessel value was about \$28.0 million. Input from industry has noted that international squid supply and demand can have strong effects on *Illex* prices. Industry has also noted that recent processing advancements and sustainability certifications have expanded markets for *Illex*. As *Illex* availability, *Illex* prices, and opportunities in other fisheries have changed, so has vessel participation in the *Illex* fishery (Table 1).

Figure 2. U.S. *Illex* Landings and Nominal *Illex* Ex-Vessel Values 1982-2019

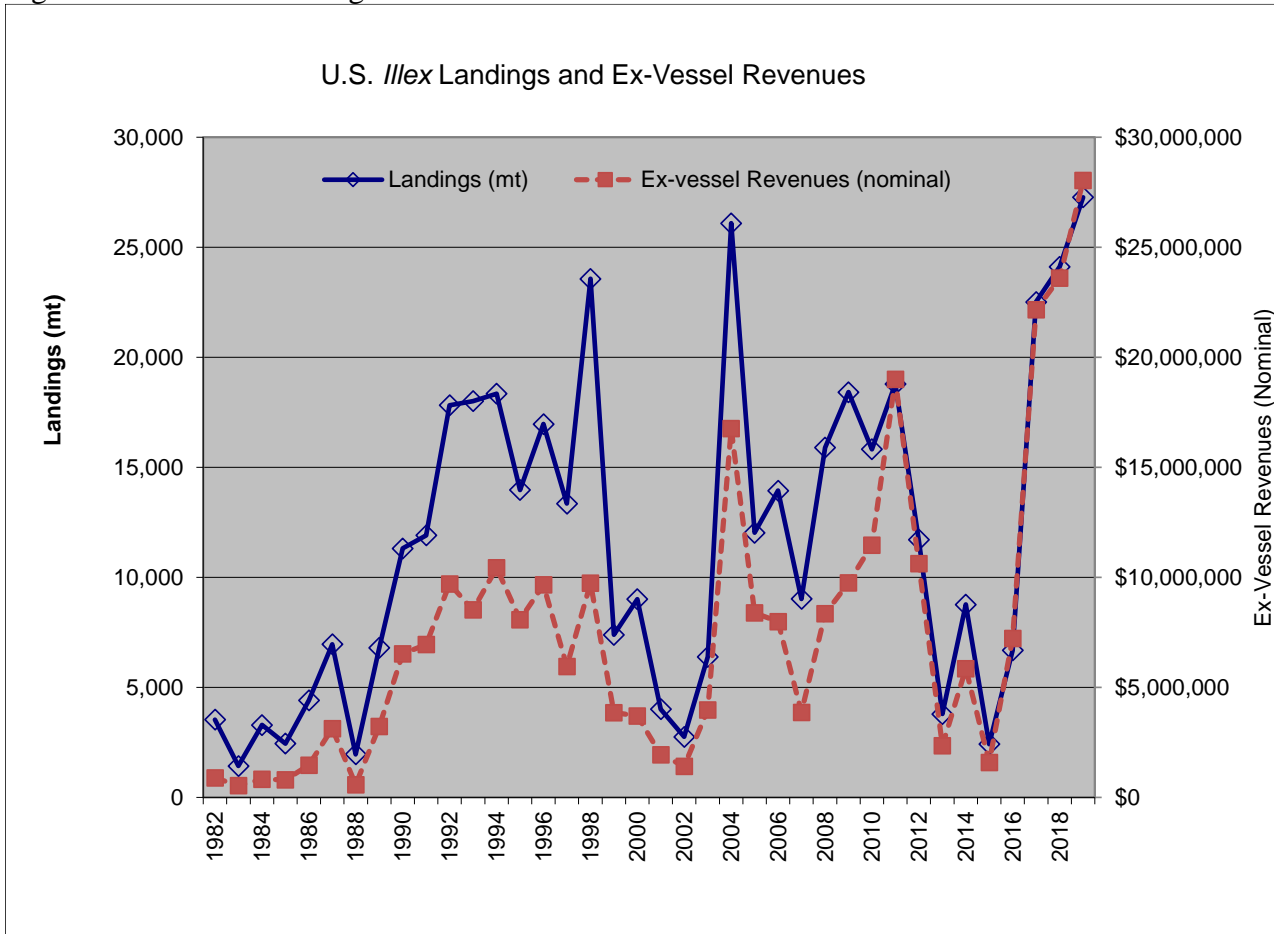
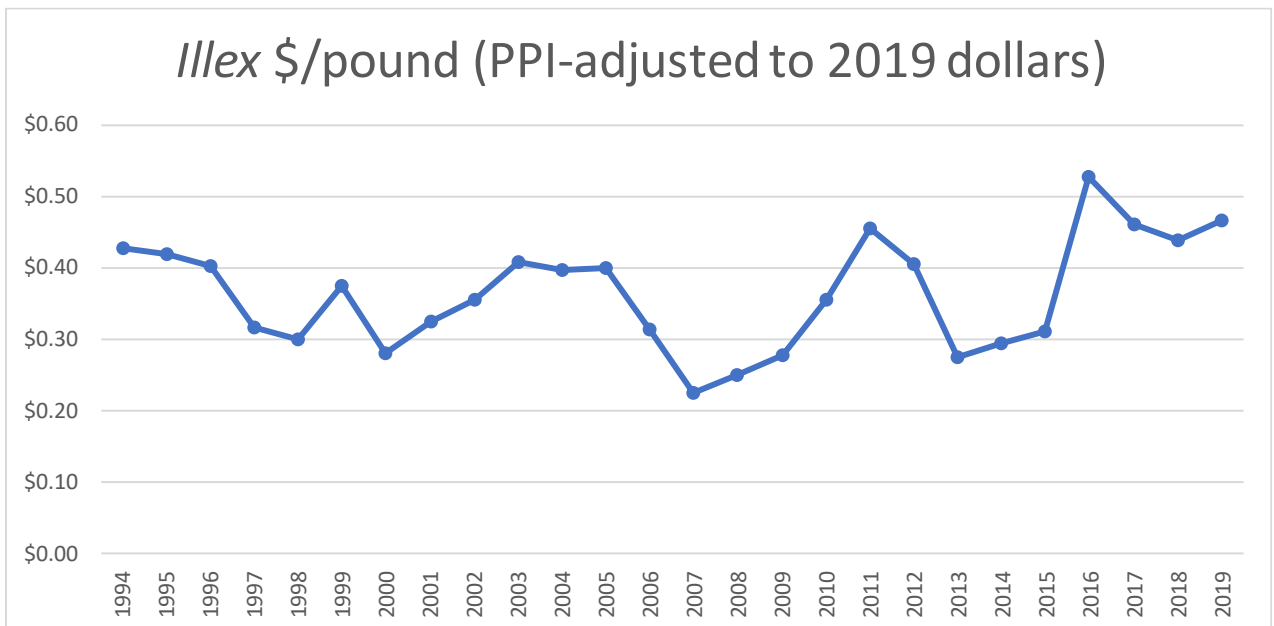


Figure 3. Ex-Vessel *Illex* Prices 1994-2019 Adjusted to 2019 Dollars Based on Producer Price Index.



Tables 1-2 provide background information on vessel activity (Table 1) and vessel length (Table 2). While imprecise, permit data suggest that the currently-permitted vessels' fish holds sum to about 9,000 MT (so if all vessels participated, the quota theoretically could be caught in several rounds of trips). The median active vessel age is about 36 years.

Table 1. 1994-2019 vessel activity (pound ranges developed previously with MSB AP).

YEAR	Vessels 500,000+	Vessels 100,000 - 500,000	Vessels 50,000 - 100,000	Vessels 10,000 - 50,000	Total
1994	21	7	5	8	41
1995	24	5	2	7	38
1996	24	5	6	4	39
1997	13	9	2	0	24
1998	25	4	1	3	33
1999	6	9	2	10	27
2000	7	7	0	2	16
2001	3	4	1	2	10
2002	2	3	1	1	7
2003	5	6	1	2	14
2004	23	5	2	0	30
2005	10	10	2	2	24
2006	9	8	1	2	20
2007	8	2	1	0	11
2008	12	4	0	0	16
2009	10	3	1	1	15
2010	12	3	0	6	21
2011	17	4	2	0	23
2012	8	3	2	2	15
2013	5	4	3	5	17
2014	5	3	2	2	12
2015	3	0	1	1	5
2016	4	3	3	2	12
2017	14	6	0	0	20
2018	19	7	0	5	31
2019	26	7	0	3	36

Table 2. *Illex* Vessel Sizes in 2019.

Length (ft)	All Active 2019 Permits	Top 15 Accounting for 81% of 2019 Landings	Top 25 Accounting for 95% of 2019 Landings
50+ to 60	2	0	0
60+ to 80	38	6	16
80+ to 100	19	3	3
100+ to 120	3	1	1
120+ to 140	3	3	3
140+ to 150	2	2	2
Totals	67	15	25

For this table, "Active" just means the permit is on a vessel and not in Confirmation of Permit History (i.e. not "on the shelf")

Cape May, NJ, North Kingston, RI, Point Judith, RI, Wanchese, NC, and Hampton, VA have historically been ports with substantial *Illex* landings. Table 3 lists the active ports in recent years, and Table 4 provides information regarding the dependence of those ports on *Illex* in 2011-2013, 2014-2016, and 2017-2019⁴. MSB Advisory Panel members have highlighted that the low relative value of *Illex* in a given port in terms of ex-vessel value may mask potential impacts to particular dealers, especially given the high value of scallops in some ports. Table 5 lists ports' share of total 2010-2019 *Illex* landings by weight. Table 6 identifies the numbers of vessels listing the relevant states as their home or principal port. Figure 4 describes fishery activity in terms of trips for 1997-2019 (median directed trip size, maximum trip size, and numbers of permits with a trip over 10,000 pounds).

Table 3. Rankings of ports with substantial *Illex* landings 2017-2019.

Port Rank	2017	2018	2019
1	Cape May	Cape May	Cape May
2	N Kingstown	N Kingstown	New Bedford
3	Pt. Judith	Pt. Judith	N Kingstown
4	Hampton, VA	New Bedford	Pt. Judith
5		Hampton, VA	Gloucester
6			Hampton, VA

Table 4. Dependence on *Illex* for Relevant Ports

	Illex as a percent of total port vessel revenues					
	Cape May	New Bedford	N. Kingston	Pt Judith	Gloucester	Hampton
2011-2013	7%	<1%	44%	1%	<1%	1%
2014-2016	2%	<1%	31%	1%	<1%	1%
2017-2019	16%	<1%	59%	4%	1%	4%

Table 5. Ports' Share of 2010-2019 *Illex* landings (by weight)

Port	% <i>Illex</i>
Cape May, NJ	47%
North Kingston, RI	35%
Point Judith, RI	7%
New Bedford, MA	6%
Hampton, VA	3%
All others	2%
Total	100%

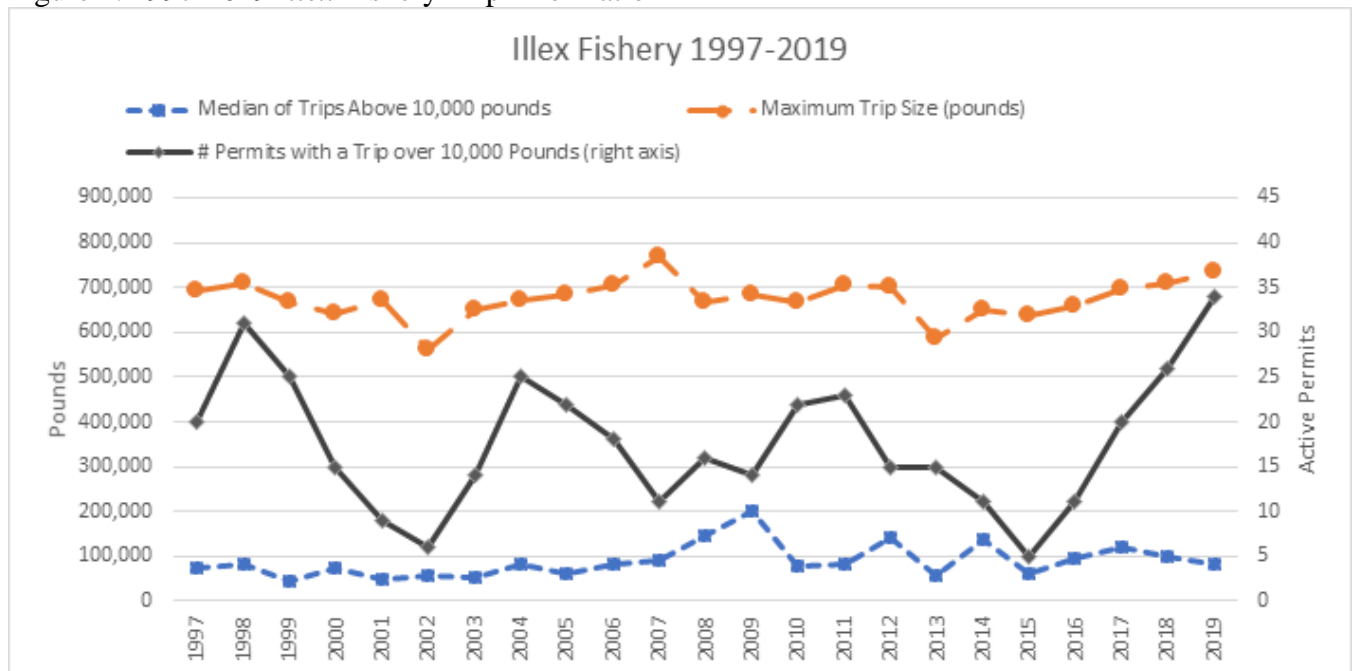
⁴ These three periods were selected to cover a variety of fishery production levels.

Table 6. *Illex* Vessels' Principal and Homeport States

Illex Permits/Vessels by principal and homeport state		
State	Principal State	Homeport State
ME	-	-
NH	-	-
MA	12	14
RI	14	11
CT	3	3
NY	4	4
NJ	26	26
PA	-	1
DE	-	-
MD	-	-
VA	6	5
NC	3	4
ACTIVE VESSELS*	68	
CPH PERMITS**	8	
TOTAL PERMITS	76	

*Vessels with *Illex* moratorium permits in 2019.
 **Confirmation of Permit History (i.e. “on the shelf”)

Figure 4. 1997-2019 *Illex* Fishery Trip Information



Figures 5-8 describe the approximate location of *Illex* catch in recent years: Figure 5 for 2018, Figure 6 for 2017, Figure 7 for 2013-2016, and Figure 8 for 2009-2012. Outliers may be the result of misreports.

Figure 5. Approximate Primary 2018 *Illex* Catch Locations (from dealer and VTR data)

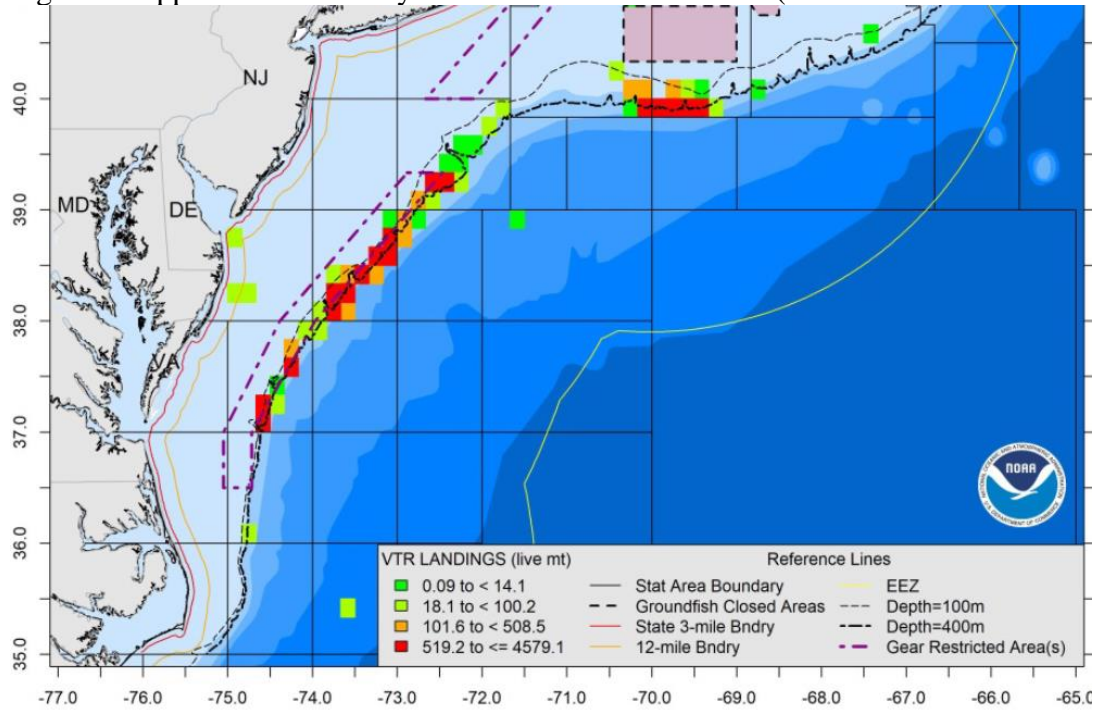


Figure 6. Approximate Primary 2017 *Illex* Catch Locations (from dealer and VTR data)

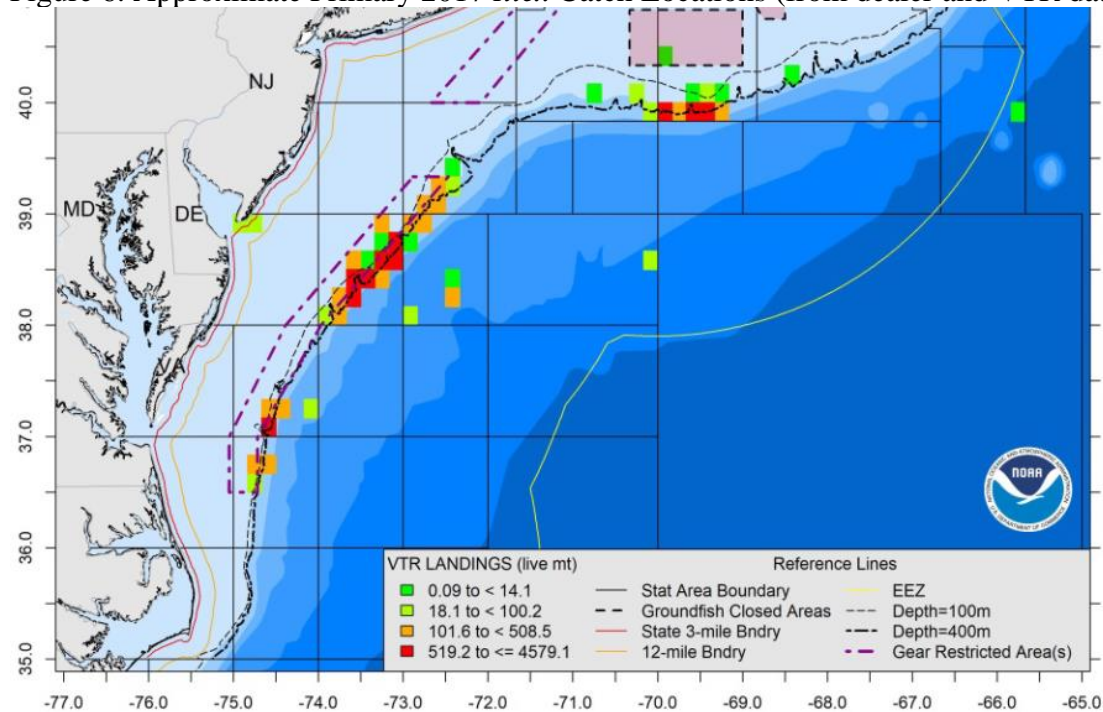


Figure 7. Approximate Primary 2013-2016 *Illex* Catch Locations (from dealer and VTR data)

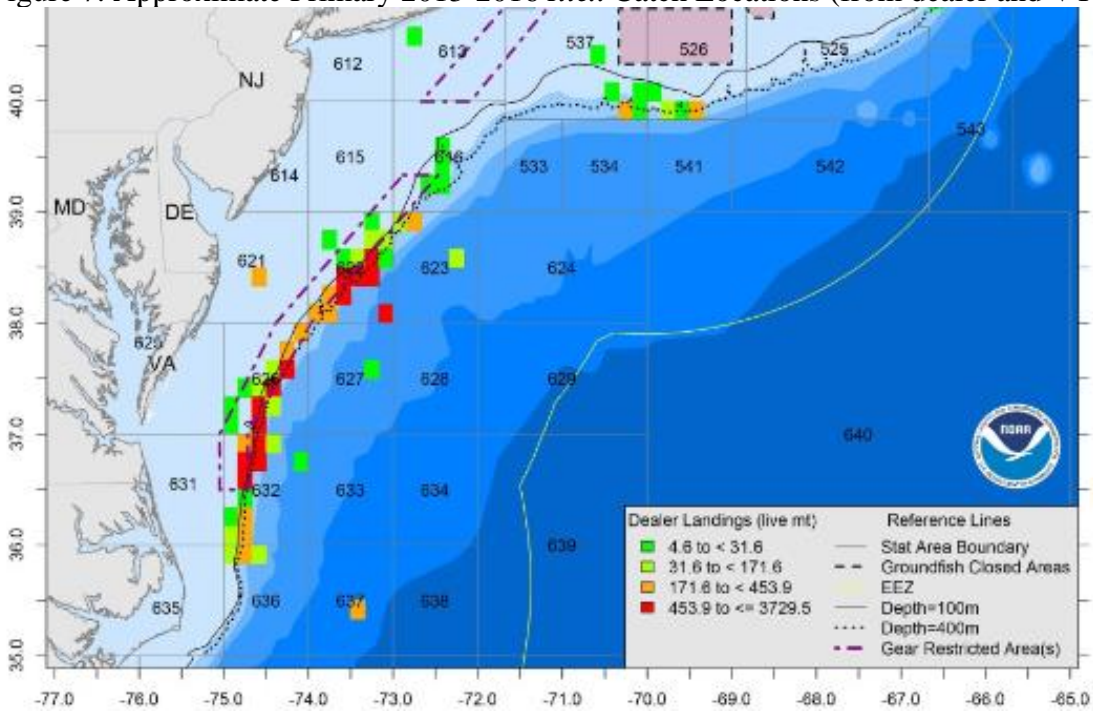
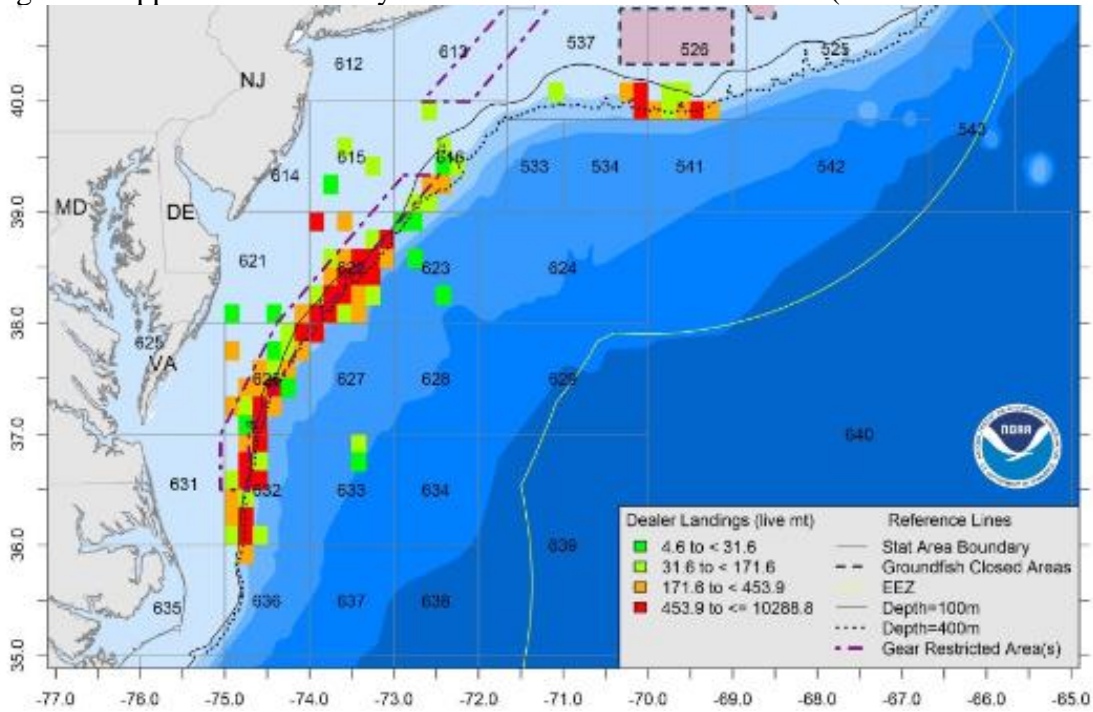


Figure 8. Approximate Primary 2009-2012 *Illex* Catch Locations (from dealer and VTR data)



Social Indicators for Fishing Communities

Social indicators are measures that describe and evaluate the social, economic, and psychological well-being of individuals or communities. They were developed to characterize community well-being for coastal communities engaged in fishing activities. First the various indices are described, and then the most recent (2016⁵) indicator ratings for the active *Illex* ports are provided. Additional details on the social vulnerability indicators is available at <https://www.fisheries.noaa.gov/national/socioeconomics/social-indicators-fishing-communities-0>.

Social Vulnerability Indices

The social vulnerability indices represent social factors that can shape either an individual or community's ability to adapt to change. These factors exist within all communities regardless of the importance of fishing.

Labor force characterizes the strength and stability of the labor force and employment opportunities that may exist. A high rank means likely fewer employment opportunities and a more vulnerable population.

Housing characteristics is a measure of infrastructure vulnerability and includes factors that indicate housing that may be vulnerable to coastal hazards. A high rank means a more vulnerable infrastructure and a more vulnerable population. On the other hand, the opposite interpretation might be that more affordable housing could be less vulnerability for some populations.

Poverty is a commonly used indicator of vulnerable populations. A high rank indicates a high rate of poverty and a more vulnerable population.

Population composition shows the presence of populations who are traditionally considered more vulnerable due to circumstances often associated with low incomes and fewer resources. A high rank indicates a more vulnerable population.

Personal disruption represents factors that disrupt a community member's ability to respond to change because of personal circumstances affecting family life or educational levels or propensity to be affected by poverty. A high rank indicates more personal disruption and a more vulnerable population.

Gentrification Pressure Indices

The gentrification pressure indices characterize those factors that, over time, may indicate a threat to the viability of a commercial or recreational working waterfront, including infrastructure.

Housing Disruption represents factors that indicate a fluctuating housing market where some displacement may occur due to rising home values and rents. A high rank means more vulnerability for those in need of affordable housing and a population more vulnerable to gentrification.

Retiree migration characterizes areas with a higher concentration of retirees and elderly people in the population. A high rank indicates a population more vulnerable to gentrification as retirees seek out the amenities of coastal living.

⁵ While *Illex* landings were not high in 2016, the indicators are general in nature and not directly related to *Illex* fishing.

Urban sprawl describes areas experiencing gentrification through increasing population and higher costs of living. A high rank indicates a population more vulnerable to gentrification.

Fishing Engagement and Reliance Indices

The fishing engagement and reliance indices portray the importance or level of dependence of commercial or recreational fishing to coastal communities.

Commercial fishing engagement measures the presence of commercial fishing through fishing activity as shown through permits, fish dealers, and vessel landings. A high rank indicates more engagement.

Commercial fishing reliance measures the presence of commercial fishing in relation to the population size of a community through fishing activity. A high rank indicates more reliance.

Recreational fishing engagement measures the presence of recreational fishing through fishing activity estimates. A high rank indicates more engagement.

Recreational fishing reliance measures the presence of recreational fishing in relation to the population size of a community. A high rank indicates increased reliance.

Climate Change Indices

The climate change indices characterize environmental conditions that may affect the sustainability of essential commercial and recreational fishing businesses and infrastructure.

Sea level rise risk signifies the overall risk of inundation from sea level rise from one foot level to six foot level projections over the next ~90 years. The indicator represents the possibility of inundation based upon the combined projections at each stage of sea level rise and could vary depending upon future circumstances. A high rank indicates a community more vulnerable to sea level rise.

Storm surge risk refers to the overall risk of flooding from hurricane storm surge categories 1-5. The indicator represents the "worst-case" possibility of inundation based on the combined hurricane storm surge categories and could vary depending on future circumstances. A high rank indicates a community more vulnerable to a particular hurricane storm surge.

Figure 9. Cape May Vulnerability Indicators

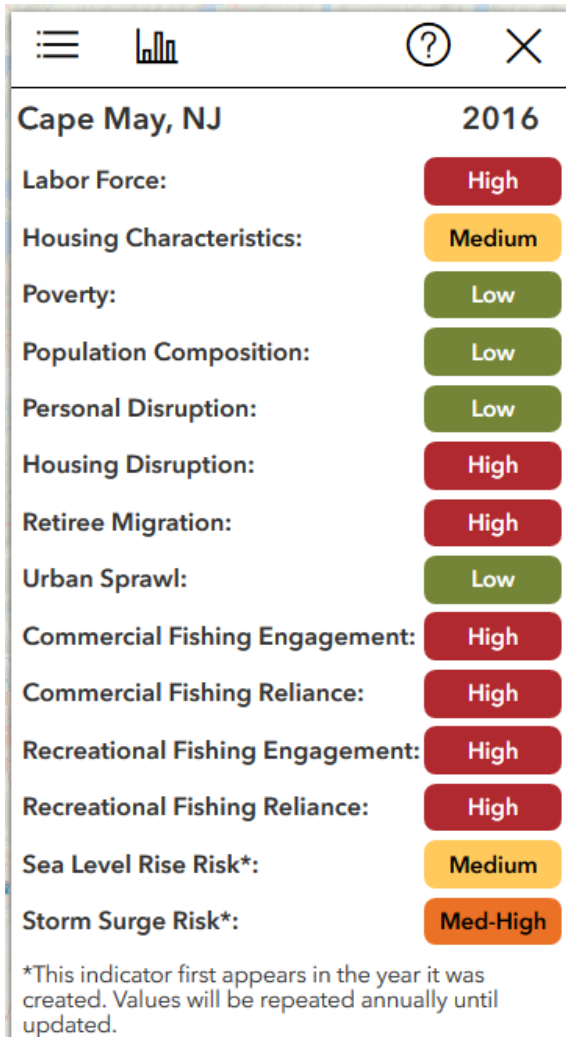


Figure 10. New Bedford Vulnerability Indicators

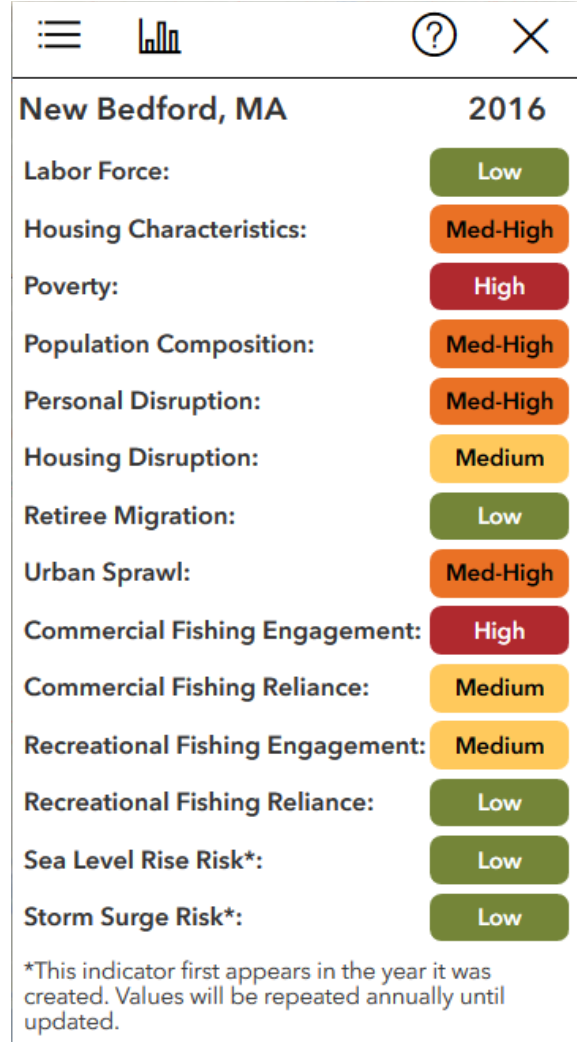


Figure 11. North Kingston/Saunderstown, RI Vulnerability Indicators

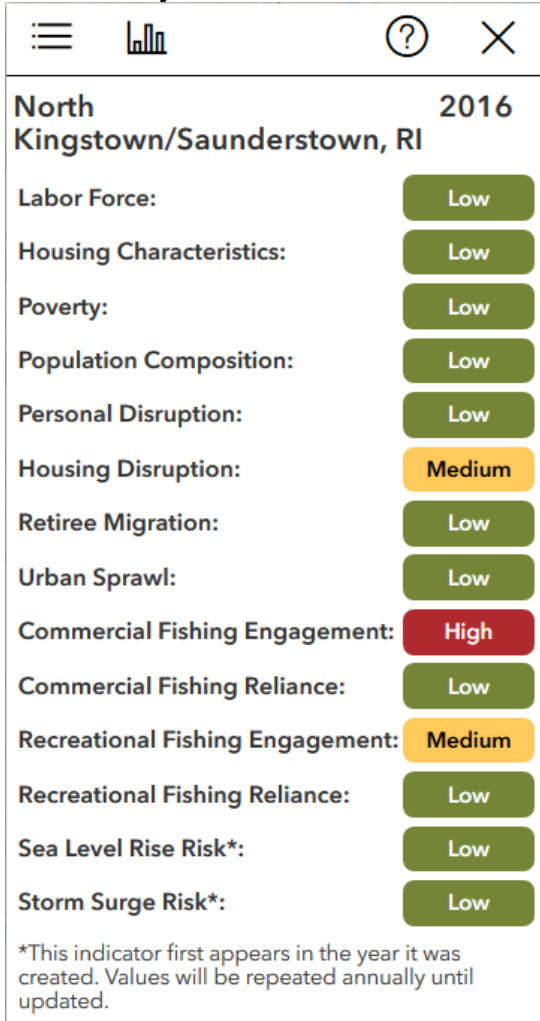


Figure 12. Narragansett/Point Judith RI Vulnerability Indicators

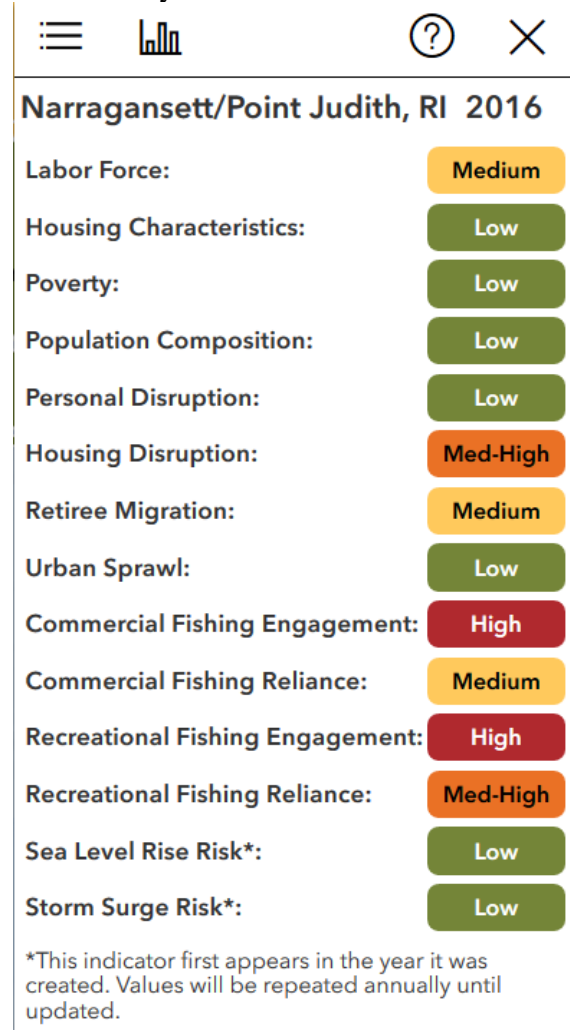


Figure 13. Gloucester, MA Vulnerability Indicators

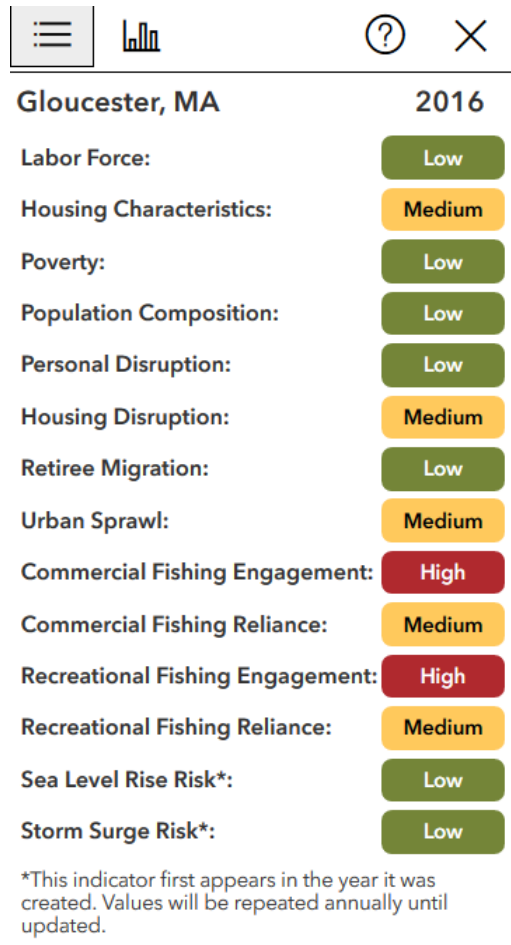
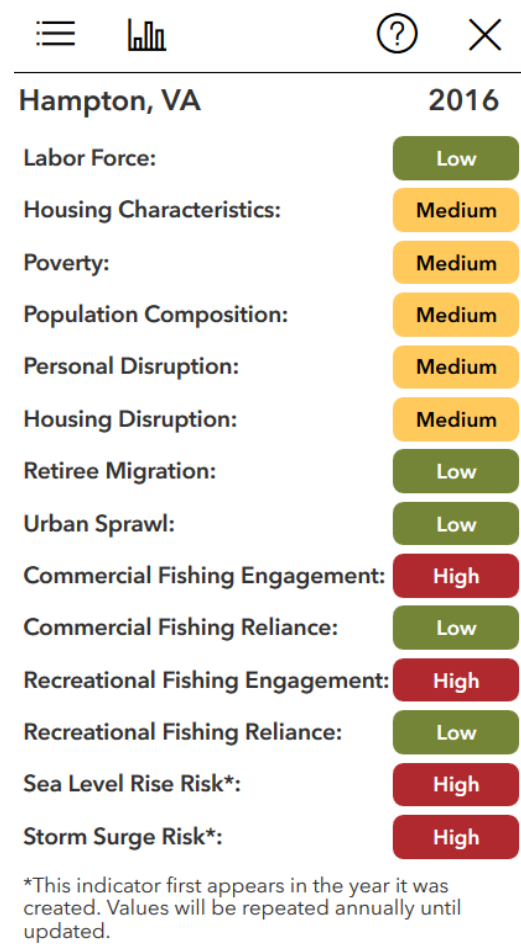


Figure 14. Hampton, VA Vulnerability Indicators



5. Current Management Measures

The 2020 ABC for *Illex* is currently 26,000 MT, with a commercial quota of 24,825 MT to account for discards (4.52%). In 2019 there were 76 limited access “moratorium” permits. These permits allow unlimited trip limits and no effort restrictions when the fishery is open. Open access incidental permits can be obtained by any vessel at any time and allow up to 10,000 pounds of *Illex* per trip. The season runs on the calendar year. The directed fishery closes when NOAA Fisheries predicts that 95% of the quota will be landed. After that closure, a 10,000 pound trip limit is in place for the remainder of the calendar year. An overview of additional management measures is available at <https://www.fisheries.noaa.gov/species/shortfin-squid-0#management>.

The original *Illex* qualification criteria for the moratorium permit were five landings of at least 5,000 pounds (including joint venture) of *Illex* between Aug 13, 1981 and August 13, 1993. In addition, a vessel that was under construction for, or was being re-rigged for, use in the directed fishery for *Illex* on August 13, 1993, qualified for a moratorium permit if 5,000 lb (2.27mt) or more of *Illex* were landed from it and sold on at least 5 trips prior to December 31, 1994. These qualification criteria became effective in June 1997 as part of Amendment 5. Extending the qualification date prior to 1988 and after August 13, 1993 occurred later in the development process to include more vessels.

6. Alternatives in this Action

Note: The term MRI or moratorium right identification may be a new term for some people. The MRI tracks fishing history of a limited access **permit** even if it moves between vessels.

No preferred alternatives have been identified at this time. If the Council decides to take action to change *Illex* permits through a requalification, the time period(s) chosen, the threshold(s) chosen, and other related management measures combine to create the effects on participants. While the Council is taking a matrix of alternatives out for public comment (there are 20 possible options between the various time period and threshold options – see Table 7), the Council may narrow the options for additional analysis prior to final action. The Council could also create an alternative that combines several options to create a tiered permit system. For example, the Council could select more restrictive requalification criteria that requalify fewer MRIs for a tier that operates as current (no trip limit), and then create a second tier managed with trip limits for the MRIs that don’t requalify under the more restrictive criteria, but would requalify under a more liberal requalification option. Tiering is discussed in more detail in Alternative Set C below.

It is generally expected that the Council will select from the time periods (Alternative Set A) and thresholds (Alternative Set B) to create requalification criteria, and then Alternative Set C may be used to create limitations for non-requalifying MRIs, or tiers. Alternative Set D options could be added to create a vessel hold measurement and baseline and/or clarify daily Vessel Monitoring System (VMS) requirements.

6A - ALTERNATIVE SET A: TIME PERIODS FOR RE-QUALIFICATION

Alternative A1: No action/status quo. No changes to the current permitting system could occur without establishing a requalification time period. The 76 2019 limited access “moratorium” permit would retain unlimited trip limits and no effort restrictions. Open access incidental permits can be obtained and allow up to 10,000 pounds of *Illex* per trip.

Introduction for time period action alternatives

The Council has developed four possible time periods for an *Illex* permit requalification. Some options consider landings through 2019 for requalification, and some do not consider landings after 2013. August 2, 2013, was published as a control date for *Illex* squid. The control date notification in the Federal Register stated that “NMFS intends this notice to promote awareness of possible rulemaking, alert interested parties of potential eligibility criteria for future access, and discourage speculative entry into and/or investment in the *Illex* squid fishery while the Council considers if and how access to the *Illex* squid fishery should be controlled.” The Council reaffirmed the August 2, 2013, control date at its August 2018 Council meeting. The alternatives are presented in approximately the order that would result in the most to the fewest requalifiers. The thresholds for amounts of landings during the time periods are considered in Alternative Set B, and the numbers of requalifiers when combining the time periods and thresholds are provided in the impacts section (Table 7).

Alternative A2: Use a requalification time period that considers landings between 1997-2019. This allows a broad consideration of historic and present participation.

Alternative A3: Use a requalification time period that considers landings between 1997-2018. This allows consideration of historic and recent participation through 2018 when then Council reaffirmed the control date and development of this action began.

Alternative A4: Use a requalification time period that considers landings between 1997-2013. This allows consideration of alternatives that utilize the control date and landings from the previous seventeen years.

Alternative A5: Use a requalification time period that considers, and requires, landings both between 1997-2013 and 2014-2019. If MRIs did not have landings in both time periods they would not requalify. This allows consideration of alternatives that requalify MRIs that demonstrate both historic and recent participation.

6B - ALTERNATIVE SET B: THRESHOLDS FOR RE-QUALIFICATION

Alternative B1: No action/status quo. No changes to the current permitting system could occur without establishing a requalification threshold. The 76 2019 limited access “moratorium” permit would retain unlimited trip limits and no effort restrictions. Open access incidental permits can be obtained and allow up to 10,000 pounds of *Illex* per trip.

Introduction for threshold action alternatives

The Council has developed five possible thresholds for an *Illex* permit requalification, focusing on the MRIs’ best year of *Illex* landings. The alternatives are presented in the order that would result in the most to the fewest requalifiers. The time periods are considered in Alternative Set A, and the numbers of

requalifiers when combining the thresholds and time periods are provided in the impacts section (Table 7).

The range of options was chosen to achieve a range of requalifying MRIs given the activity levels observed in the fishery. All of the poundage options also represent thresholds that account for the majority of landings in most years. For example, MRIs landing over 1,000,000 pounds accounted for 85-95% of landings from 2014-2019. MRIs landing at least 50,000 pounds accounted for at least 99% of landings in the same period. So based on how the fishery operates, these thresholds represent either a strong majority of landings in a given year or nearly all landings in a given year. For each alternative, a MRI whose *Illex* landings exceed the threshold in at least one year during the period(s) identified in Alternative Set A above would requalify and be able to continue to land an unlimited amount of *Illex* squid until the fishery is closed. All analyses are based on landed weight.

Alternative B2: Use a threshold of at least 50,000 pounds in a MRI's best year during the requalification period selected in Alternative Set A.

Alternative B3: Use a threshold of at least 100,000 pounds in a MRI's best year during the requalification period selected in Alternative Set A.

Alternative B4: Use a threshold of at least 300,000 pounds in a MRI's best year during the requalification period selected in Alternative Set A.

Alternative B5: Use a threshold of at least 500,000 pounds in a MRI's best year during the requalification period selected in Alternative Set A.

Alternative B6: Use a threshold of at least 1,000,000 pounds in a MRI's best year during the requalification period selected in Alternative Set A.

6C - ALTERNATIVE SET C: PROVISIONS FOR TIERS AND/OR NON-REQUALIFYING PERMITS.

In October 2019 the Council requested that the FMAT develop potential options for a tiered permit system. As discussed above, the Council could use a mix of the requalification criteria to construct tiers. The Council also voted to add to this document an example combination of measures for requalification: Alternative A4, landings between 1997-2013 with the current Alternative B5, a threshold of 500,000 lbs. (best year between 1997-2013), creating TIER 1, **and** Alternative A2, landings between 1997-2019, with Alternative B2, a threshold of 50,000 lbs. (best year between 1997-2019), creating TIER 2. **This is not a preferred alternative**, only an example of how alternatives from sets A and B above could be mixed to create tiers when the Council takes final action. In this example, there would be 34 MRIs in tier 1 based on the 1997-2013 and 500,000-pound criteria (see Table 7). 51 MRIs would qualify under the 1997-2019 50,000-pound criteria (see Table 7), so the difference, $51 - 34 = 17$ MRIs that would become tier 2, potentially limited by a trip limit (options discussed below). The 25 MRIs that didn't meet either qualification ($76 - 51 = 25$) could be restricted at one of the lower trip limit options described below. Different combinations of alternatives would result in different groupings of MRIs that fit into each tier. The public is welcome to recommend a different combination of measures for any potential tier system.

The FMAT discussed options for limiting tiers, and recommended against a separate quota, as that might effectively increase the race to fish, or just create multiple races to fish (one for each tier). Accordingly,

the other two ways to limit any tiers would be days at sea or trip limits. The Council has previously indicated that it is not interested in a days at sea approach, which leaves trip limits. Trip limits are not a perfect way to limit effort in this high-volume fishery, because of the way catch is handled and the potential for discarding to occur as vessels near/achieve their trip limit. There is also difficulty in enforcing trip limits on a high volume fishery. However, given the Council's intent, trip limits appear to be the only remaining practicable way to limit a tier. In all cases, trip limits would be a measure that could be monitored and changed via annual specifications. A range of trip limits has been considered as listed below.

For alternatives C4-C6: During a January 8, 2019, FMAT meeting, the FMAT discussed the trip limit issue, and public comments noted that given the nature of the *Illex* fishery (high volume with substantial travel time), trip limits up to 48,000 pounds do not allow any real directed fishing and that higher trip limits should be considered. To explore this issue, staff sorted 2019 trips by the 17 permits (51-34=17) that would not qualify under a 1997-2013 500,000 pound criteria but would qualify under a more liberal 1997-2019 50,000 pound criteria (see Table 7). Those permits made 157 trips over 10,000 pounds in 2019. The median pounds of *Illex* on those trips was 66,485 pounds (50% are above and below that amount), 75% of the trips were below 85,000 pounds, and 95% of trips were below 124,000 pounds. During review of the FMAT summary after the call, the FMAT concurred that these thresholds could be used as the basis for additional (higher) trip limit options for tiers. For comparison, if similar 2017-2019 trips are pooled (i.e. not just 2019), the numbers C4-C6 are each around 10% less. **It is critical to note that while the criteria to identify trips match the re-qualification example above, these criteria were not selected to indicate a preferred requalification option, but to develop an expanded range of possible trip limits for tiers based on recent fishery performance. The Council may or may not use tiers, and the Council may use other combinations from alternative sets A and B to create tiers.**

Alternative C1: No action/status quo. No additional trip limits would be considered, so non-requalifying MRIs would only be eligible for an open-access incidental catch squid/butterfish permit that allows up to 10,000 lb of *Illex* squid per trip.

Alternative C2: Use longfin squid approach of providing non-requalifying/tiered MRIs with double the current incidental permit limit (10,000 pounds * 2 = 20,000 pounds) in consideration of their historic participation that qualified them originally for the *Illex* permit, but does not meet the requalification criteria.

Alternative C3: Provide non-requalifying/tiered MRIs with a 48,000 pound trip limit. Trips landing up to 48,000 pounds 1997-2018 only accounted for 5% of landings, so 48,000 pounds could be a *higher than incidental* trip limit that shouldn't result in using a large percentage of the quota (but performance would need to be monitored in case 48,000 pound trips utilized more of the quota than anticipated).

Alternative C4: Provide non-requalifying and/or tiered MRIs with a 67,000 pound trip limit.

Alternative C5: Provide non-requalifying and/or tiered MRIs with an 85,000 pound trip limit.

Alternative C6: Provide non-requalifying and/or tiered MRIs with a 124,000 pound trip limit.

6D - ALTERNATIVE SET D: OTHER *ILLEX* PERMITTING MANAGEMENT MEASURES

In Set D the Council is considering several other alternatives that could accompany the requalification options. The Council had some discussion of a start date for the *Illex* fishery and the FMAT discussed additional changes to reporting, but the FMAT recommended that these particular issues are not ripe for action given ongoing work of the *Illex* Working Group, which may generate relevant information on *Illex* growth, productivity, and more responsive monitoring/assessment approaches.

Alternative D1: No action/status quo. No changes to other *Illex* management measures.

Alternative D2: Require a maximum volumetric fish hold measurement for limited access *Illex* MRIs. To remain in the *Illex* limited access fishery, vessels would be required to obtain a fish hold measurement from an individual credentialed as a Certified Marine Surveyor with a fishing specialty by the National Association of Marine Surveyors (NAMS) or from an individual credentialed as an Accredited Marine Surveyor with a fishing specialty by the Society of Accredited Marine Surveyors (SAMS). Vessels that are upgraded or used as replacement vessels would have to be resurveyed by a surveyor (accredited as above) unless the replacement vessel already had an appropriate certification and the documentation would have to be submitted to NMFS. Vessels that are sealed by the Maine State Sealer of Weights and Measures will also be deemed to meet this requirement. The hold capacity measurement would serve as another permit baseline in addition to existing vessel length and horsepower baselines. The fish hold baseline would be established by the vessel issued the *Illex* limited access permit at the time this action becomes effective, if approved, or by the first replacement vessel in excess of 25 feet length overall. The fish hold volume could be increased by up to 10 percent of the MRI's baseline hold measurement, whether through refitting or vessel replacement. For vessels that are also issued an Atlantic Mackerel Tier 1 or 2 permit and have previously established a fish hold baseline, existing hold measurements and baseline from the mackerel permit would be used if the *Illex* permit is issued to the same vessel that established the mackerel fish hold baseline. NMFS may provide additional suggestions to refine this measure based on lessons learned implementing the mackerel fish hold baseline

NMFS staff has noted concerns with enforcing the upgrade restrictions – they don't have anyone to inspect fish holds and rely on the documentation provided by applicants and surveyors. The FMAT has also noted that while there might be some impact on capacity utilization by regulating fish hold, there are many factors that can affect capacity use.

Alternative D3: Clarify that daily catch of *Illex* is required via Vessel Monitoring Systems (VMS) for vessels with limited access *Illex* permits. Vessels are currently required to declare into the *Illex* fishery with VMS but some of the language for daily catch reporting is vague.

7. Impacts of the Alternatives



This section summarizes the expected potential impacts of this action. Biological and socioeconomic, as well as potential impacts to habitat and protected species, will be analyzed in more detail in an environmental assessment which will be finalized in accordance with the National Environmental Policy Act after the Council selects preferred alternatives (scheduled for June 2020). Significant habitat and/or protected species impacts are not expected. The environmental assessment would be subject to an additional public comment period during the proposed rule phase.

The impacts of the alternatives depend on how many of the 2019 76 *Illex* MRIs⁶ requalify, what their recent participation in the fishery has been, and what restrictions are placed on non-requalifiers. The first step in understanding impacts is to identify how many MRIs re-qualify (or not) under each alternative, and what their fishery participation has been. Approximately 13 MRIs had no landings during any time period under consideration.

Re-Qualifiers



Table 7 provides the numbers of MRIs that **do** requalify and Table 8 (next page) provides the numbers that **do not** requalify for each combination of requalifying time period (Alternative Set A) and threshold (Alternative Set B). The numbers of non-requalifiers equal 76 (*the current total*) minus the number of requalifiers. For both tables, the percentage of permit reduction is provided in parentheses.

Table 7. Numbers of Requalifiers and Percent Permit Reduction from 76 2019 Limited Access Permits for Each Possible Time Period and Threshold Option.

Note: All re-qualifier estimates preliminary.		More re-qualifiers  Less re-qualifiers				
Percent in parentheses is percent reduction of MRIs(1) (76 total in 2019)	Thresholds	At least 50,000 pounds in any one year	At least 100,000 pounds in any one year	At least 300,000 pounds in any one year	At least 500,000 pounds in any one year	At least 1,000,000 pounds in any one year
	Qualification Periods					
More re-qualifiers	1997-2019	51 (-33%)	49 (-36%)	47 (-38%)	45 (-41%)	35 (-54%)
	1997-2018	50 (-34%)	48 (-37%)	44 (-42%)	41 (-46%)	30 (-61%)
	1997-2013	43 (-43%)	42 (-45%)	38 (-50%)	34 (-55%)	28 (-63%)
Less re-qualifiers	Need landings in both 1997-2013 and 2014-2019	30 (-61%)	30 (-61%)	27 (-64%)	21 (-72%)	13 (-83%)
(1) A Moratorium Rights Identifier (MRI) is a unique NMFS-issued number that identifies a unique permit history, and may move between vessels over time.						

⁶ MRI = Moratorium right ID, which tracks fishing history of a limited access permit even if it moves between vessels.

Table 8. Numbers of Non-Requalifiers and Percent Permit Reduction from 76 2019 Limited Access Permits for Each Possible Time Period and Threshold Option.

Note: All re-qualifier estimates preliminary.		More re-qualifiers  Less re-qualifiers				
Percent in parentheses is percent reduction of MRIs(1) (76 total in 2019)	Thresholds	At least 50,000 pounds in any one year	At least 100,000 pounds in any one year	At least 300,000 pounds in any one year	At least 500,000 pounds in any one year	At least 1,000,000 pounds in any one year
	Qualification Periods					
More re-qualifiers	1997-2019	25 (-33%)	27(-36%)	29 (-38%)	31 (-41%)	41 (-54%)
	1997-2018	26 (-34%)	28 (-37%)	32 (-42%)	35 (-46%)	46 (-61%)
	1997-2013	33 (-43%)	34 (-45%)	38 (-50%)	42 (-55%)	48 (-63%)
Less re-qualifiers	Need landings in both 1997-2013 and 2014-2019	46 (-61%)	46 (-61%)	49 (-64%)	55 (-72%)	63 (-83%)
(1) A Moratorium Rights Identifier (MRI) is a unique NMFS-issued number that identifies a unique permit history, and may move between vessels over time.						

Potential Impact Relative to Recent Landings

The next step is to identify how ***Illex* landings** might be impacted based on the requalification options. Tables 9-11 identify how much of the landings in three time periods, 2011-2013, 2014-2016, and 2017-2019 (one table per timeframe) were made by permits that would **not** requalify under each option. The take home message from these tables is that if the most recent (2019) landings are not used for requalification, MRIs representing about 1%-13% of 2017-2019 *Illex* landings (see Table 11) would not be able to participate in the directed fishery, or could be subject to reduced trip limits, depending on Council action in other alternative sets. The threshold also partially determines what part of landings would have been affected. Given that under the most restrictive option at most 19% of landings would have been affected, and given the early closures in recent years, during a good year the remaining requalifying MRIs could likely make up the potential “lost” proportion of catch at current quota levels. In other words, the MRIs that would requalify under each alternative would likely still be able to catch the current quota if the landings of non-requalifying MRIs are reduced. During slower fishing years, eliminating some more recently-active MRIs may reduce total landings and the probability of achieving the quota (less vessels would be out looking for *Illex*). However, it is not possible to determine how much landings might be reduced because participation will broadly change during slower fishing years.

Table 9. Percent of total 2011-2013 *Illex* landed by MRIs that would not requalify under each requalification option.

		Percent of total 2011-2013 <i>Illex</i> landed by MRIs that would not requalify under each requalification option				
Thresholds Qualification Periods	At least 50,000 pounds in any one year	At least 100,000 pounds in any one year	At least 300,000 pounds in any one year	At least 500,000 pounds in any one year	At least 1,000,000 pounds in any one year	
	1997-2019	0%	0%	0%	0%	4%
1997-2018	0%	0%	0%	0%	4%	
1997-2013	0%	0%	1%	1%	4%	
Need landings in both 1997-2013 and 2014-2019	4%	4%	5%	6%	12%	

Table 10. Percent of total 2014-2016 *Illex* landed by MRIs that would not requalify under each requalification option.

		Percent of total 2014-2016 <i>Illex</i> landed by MRIs that would not requalify under each requalification option				
Thresholds Qualification Periods	At least 50,000 pounds in any one year	At least 100,000 pounds in any one year	At least 300,000 pounds in any one year	At least 500,000 pounds in any one year	At least 1,000,000 pounds in any one year	
	1997-2019	0%	0%	0%	0%	1%
1997-2018	0%	0%	0%	0%	1%	
1997-2013	0%	0%	2%	2%	2%	
Need landings in both 1997-2013 and 2014-2019	0%	0%	2%	2%	3%	

Table 11. Percent of total 2017-2019 *Illex* landed by MRIs that would not requalify under each requalification option.

		Percent of total 2017-2019 <i>Illex</i> landed by MRIs that would not requalify under each requalification option				
Thresholds Qualification Periods	At least 50,000 pounds in any one year	At least 100,000 pounds in any one year	At least 300,000 pounds in any one year	At least 500,000 pounds in any one year	At least 1,000,000 pounds in any one year	
	1997-2019	0%	0%	0%	1%	5%
1997-2018	1%	1%	3%	5%	11%	
1997-2013	8%	8%	9%	12%	13%	
Need landings in both 1997-2013 and 2014-2019	8%	8%	9%	13%	19%	

Dependence on *Illex* by Non-Requalifying and Requalifying MRIs

Tables 12-14 describe non-requalifiers *Illex* landings **as a percent of their total landings (by weight)**. Non-requalifiers were more dependent on *Illex* since 2017.

Table 12. Non-requalifiers total *Illex* landings as a percent of ***their*** total landings during **2011-2013**

		Non-requalifiers total <i>Illex</i> landings as a percent of their total landings during 2011-2013				
Thresholds Qualification Periods		At least 50,000 pounds in any one year	At least 100,000 pounds in any one year	At least 300,000 pounds in any one year	At least 500,000 pounds in any one year	At least 1,000,000 pounds in any one year
		1997-2019	0%	0%	0%	0%
1997-2018	0%	0%	0%	0%	4%	
1997-2013	0%	0%	1%	1%	3%	
Need landings in both 1997-2013 and 2014-2019	3%	3%	4%	5%	6%	

Table 13. Non-requalifiers total *Illex* landings as a percent of ***their*** total landings during **2014-2016**

		Non-requalifiers total <i>Illex</i> landings as a percent of their total landings during 2014-2016				
Thresholds Qualification Periods		At least 50,000 pounds in any one year	At least 100,000 pounds in any one year	At least 300,000 pounds in any one year	At least 500,000 pounds in any one year	At least 1,000,000 pounds in any one year
		1997-2019	0%	0%	0%	0%
1997-2018	0%	0%	0%	0%	0%	
1997-2013	0%	0%	1%	1%	1%	
Need landings in both 1997-2013 and 2014-2019	0%	0%	1%	1%	1%	

Table 14. Non-requalifiers total *Illex* landings as a percent of ***their*** total landings during **2017-2019**

		Non-requalifiers total <i>Illex</i> landings as a percent of their total landings during 2017-2019				
Thresholds Qualification Periods		At least 50,000 pounds in any one year	At least 100,000 pounds in any one year	At least 300,000 pounds in any one year	At least 500,000 pounds in any one year	At least 1,000,000 pounds in any one year
		1997-2019	0%	0%	1%	3%
1997-2018	4%	4%	12%	17%	26%	
1997-2013	22%	22%	24%	27%	28%	
Need landings in both 1997-2013 and 2014-2019	20%	20%	22%	27%	27%	

Tables 15 and 16 count the number of **non-requalifying (Table 15)** and then *requalifying (Table 16)* MRIs that had *Illex* representing at least 25% of their 2019 revenues for each alternative set. Not using the most recent years to requalify MRIs results in more MRIs not requalifying that had *Illex* as at least 25% of their 2019 revenues. The threshold is also important – the higher thresholds exclude a higher number of MRIs that had *Illex* as a substantial percent of their 2019 revenues. More requalifiers had *Illex* as at least 25% of their 2019 revenues (Table 16 vs Table 15).

Table 15. Number of non-requalifying MRIs that had *Illex* representing at least 25% of their 2019 revenues for each qualification period and landing threshold combination.

		Number of non-requalifying vessels that had <i>Illex</i> representing at least 25% of their 2019 revenues under each requalification option.				
Thresholds		At least 50,000 pounds in any one year	At least 100,000 pounds in any one year	At least 300,000 pounds in any one year	At least 500,000 pounds in any one year	At least 1,000,000 pounds in any one year
Qualification Periods						
1997-2019		0	0	0	0	3
1997-2018		1	1	3	4	8
1997-2013		6	6	6	8	9
Need landings in <u>both</u> 1997-2013 and 2014-2019		6	6	6	10	14

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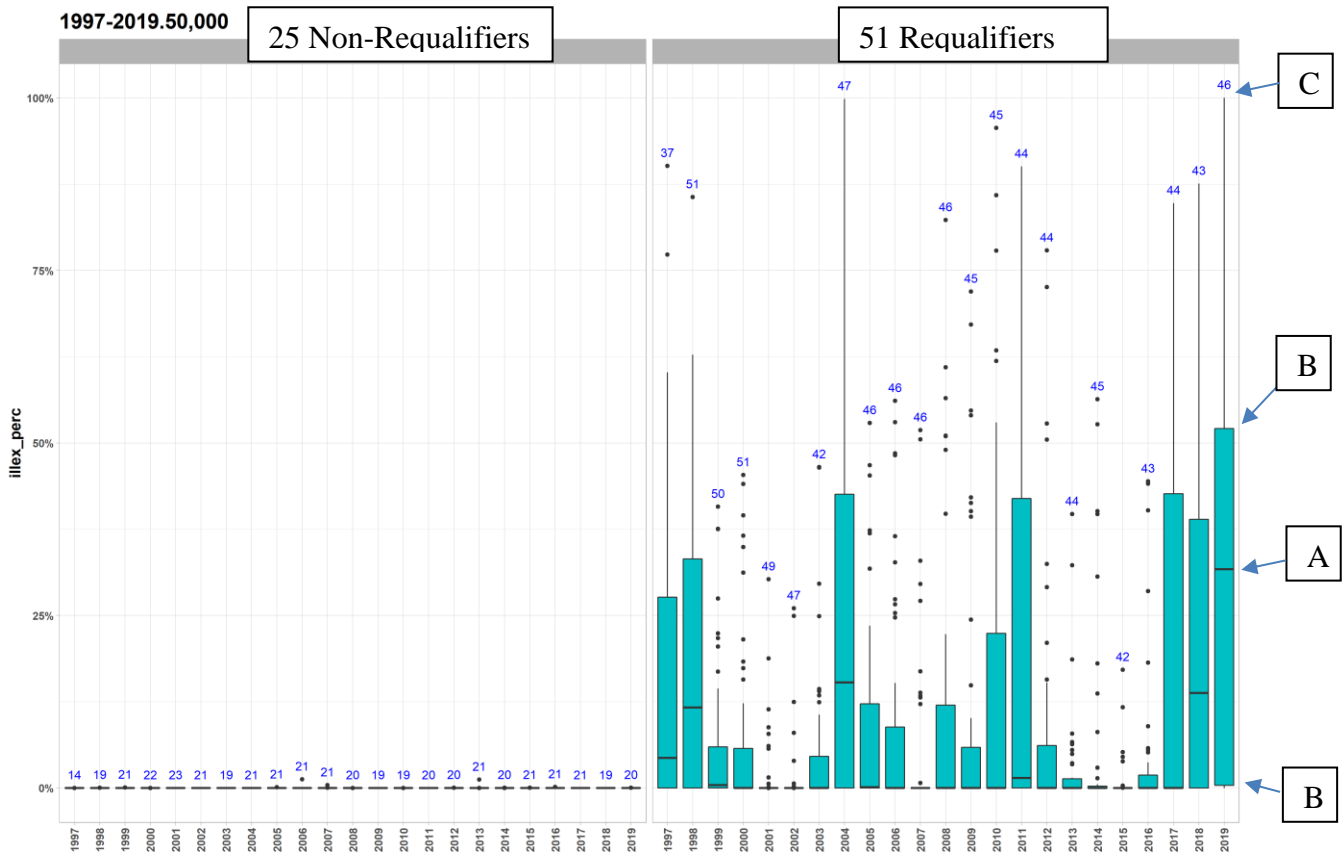
Table 16. Number of requalifying MRIs that had *Illex* representing at least 25% of their 2019 revenues for each qualification period and landing threshold combination.

		Number of requalifying vessels that had <i>Illex</i> representing at least 25% of their 2019 revenues under each requalification option.				
Qualification Periods	Thresholds	At least 50,000 pounds in any one year	At least 100,000 pounds in any one year	At least 300,000 pounds in any one year	At least 500,000 pounds in any one year	At least 1,000,000 pounds in any one year
	1997-2019		25	25	25	25
1997-2018		24	24	22	21	17
1997-2013		19	19	19	17	16
Need landings in both 1997-2013 and 2014-2019		19	19	19	15	11

Tables 15 and 16 above were the results for 2019 from a broader analysis that looked at each MRI’s annual dependence on *Illex* for revenues over time from 1997-2019. We cannot list *Illex* dependence for each permit due to data confidentiality constraints, but figures called “boxplots” can communicate the information for the fleet in some detail. Appendix A provides boxplot figures that describe the requalifying and non-requalifying MRI’s annual dependence on *Illex* for each time period/threshold option (20 figures). Three of those options are provided below, both to explain how to generally interpret the figures in Appendix A and because their comparative findings are generally instructive. They are not chosen to suggest them as preferred options. The example time period/threshold options are: 1997-2019 with 50,000 pounds in any year (requalifies the most), 1997-2013 plus 2014-2019 with 1,000,000 pounds in one year in each (requalifies the least), and 1997-2013 with 300,000 pounds in any year (middle option). The general result is that more MRIs are impacted, and impacted to a greater degree, if more recent years are not used for requalification, or if higher thresholds are used, especially relative to their recent landings.

In Appendix B, a series of similar boxplots is shown for seasonal (June 1-Sept 30) dependence on *Illex* (revenues) for the various requalification options. For MRIs with some dependence on *Illex*, be they requalifiers or non-requalifiers, they generally have higher dependence during June 1-September than when considering the full year.

Figure 15. MRI *Illex* Revenue Dependencies for the 1997-2019/50,000-pound option. Bar is the interquartile (middle) range (IQR); black horizontal line is the median; vertical lines extend to observations near 1.5 * IQR; outliers are dots.



This is an example figure from the 20 figures in Appendix A and describes *Illex* dependency relative to all revenues for the 1997-2019/50,000 pounds requalification option. Dependence on *Illex* revenues for **non**-requalifiers is on the **left** and for **requalifiers** is on the **right**. The blue numbers for each year show the MRIs that had at least some revenues (any species) in each year. For example there are 51 requalifiers in this option but in 2019 only 46 had some revenues from any species (“C”). The median of active MRIs’ *Illex* dependence is represented by a black horizontal line (e.g. “A”). If the median is zero (or close to zero) in a year it will not be visible. The solid bars indicate the typical (i.e. the middle 50% group) MRIs’ dependence on *Illex* revenues. This is called the interquartile range (IQR). If no bar is visible then that middle group’s dependence is at or near zero for that year. The vertical lines or “whiskers” extend to an observation about 1.5 times the IQR to highlight outliers (the dots) even further out. This boxplot (Figure 15) shows that for the 1997-2019/50,000 pounds option there are no non-requalifiers with any substantial ongoing dependence on *Illex* (note the nearly empty left side). There is a wide range of dependencies for the 51 requalifying MRIs on the right side. In 2019, the median dependency on *Illex* by requalifiers (far right) was about 30% (“A”) and the typical MRIs (middle 50% of MRIs) ranged from 0% dependence to about 50% dependence (“Bs”) but at least one had about 100% dependence on *Illex* (the top of the vertical line near “C”).

Figure 16. MRI *Illex* Revenue Dependencies for the 1997-2013 plus 2014-2019 with 1,000,000 pounds in one year in each period option.

Bar is the interquartile (middle) range (IQR); black horizontal line is the median; vertical lines extend to observations near $1.5 * IQR$; outliers are dots.

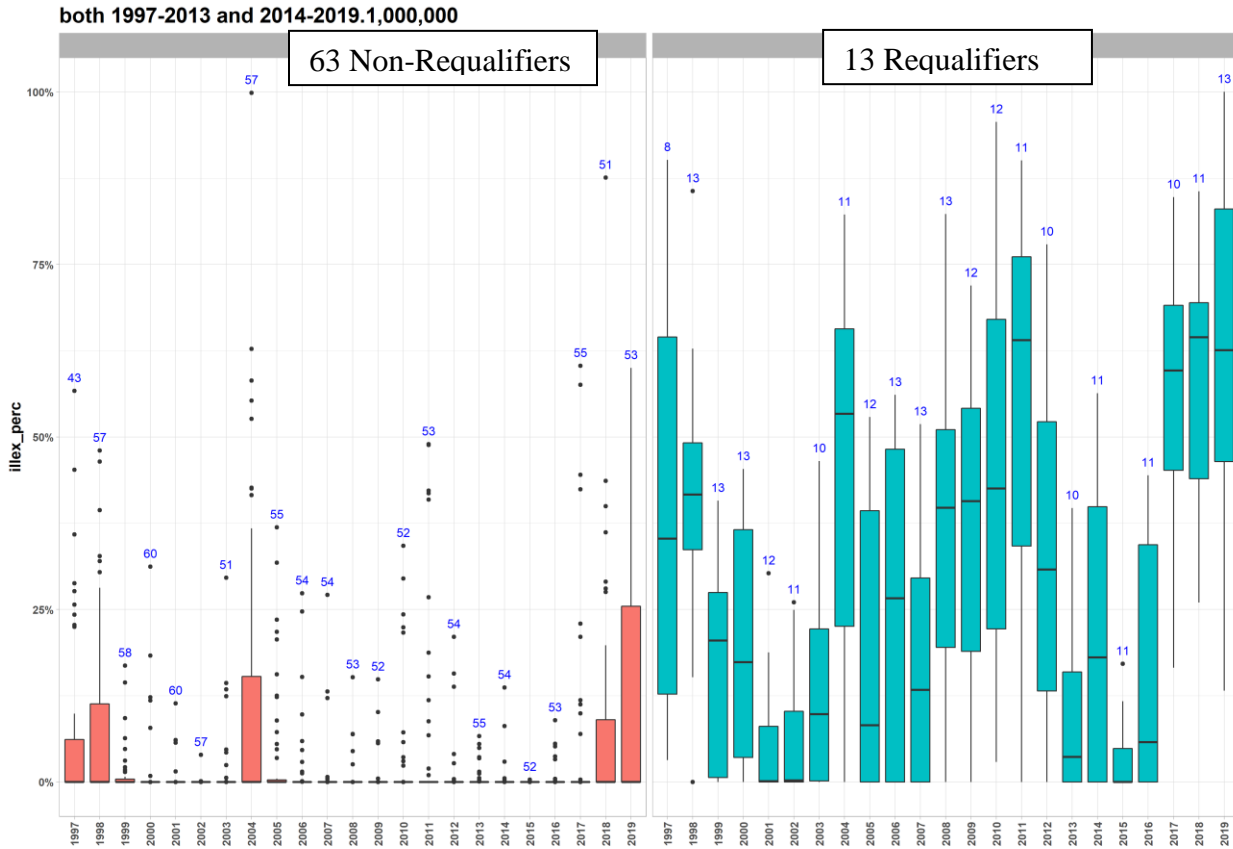


Figure 16 contrasts with Figure 15 since the 1997-2013 plus 2014-2019 with 1,000,000 pounds in one year in each period option requalifies the fewest (13) MRIs. While in most years most non-requalifiers (left side) still had relatively little dependence on *Illex* (the bars are on or near zero in most years), there are some years where the range of the bars (representing the middle 50% of MRIs) extends beyond 10% dependence (including in 2019 which was above 25%), and there are numerous outliers in nearly every year, indicating ongoing participation but not enough to requalify under this option. There is a wide range of dependencies for the 13 requalifiers, and the requalifying MRIs tend to have relatively high dependencies compared to other options.

Figure 17. MRI *Illex* Revenue Dependencies for the 1997-2013/300,000 pounds option. Bar is the interquartile (middle) range (IQR); black line horizontal is the median; vertical lines extend to observations near 1.5 * IQR; outliers are dots.

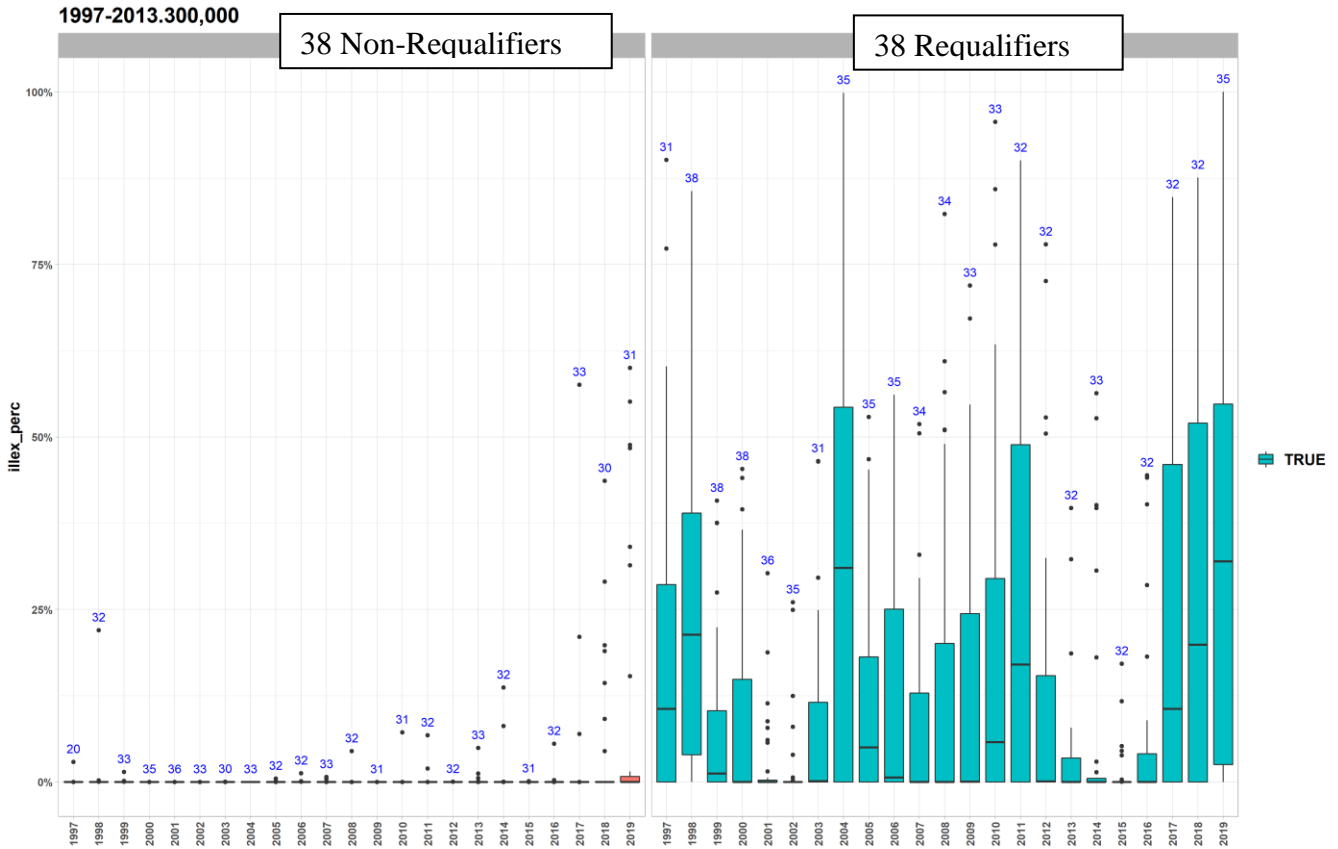


Figure 17 above illustrates a relative middle ground between the other two illustrated extremes from an analytical perspective - these are the results for the requalification using 1997-2013 with 300,000 pounds in any year (38 requalifiers). Most non-requalifying MRIs have minimal dependence on *Illex*, as evidenced by the bars on the left being at or near zero, but there are a number of outliers that had more dependence, especially in the most recent years, as would be expected given this option utilizes the 2013 control date.

Participation in Other Fisheries

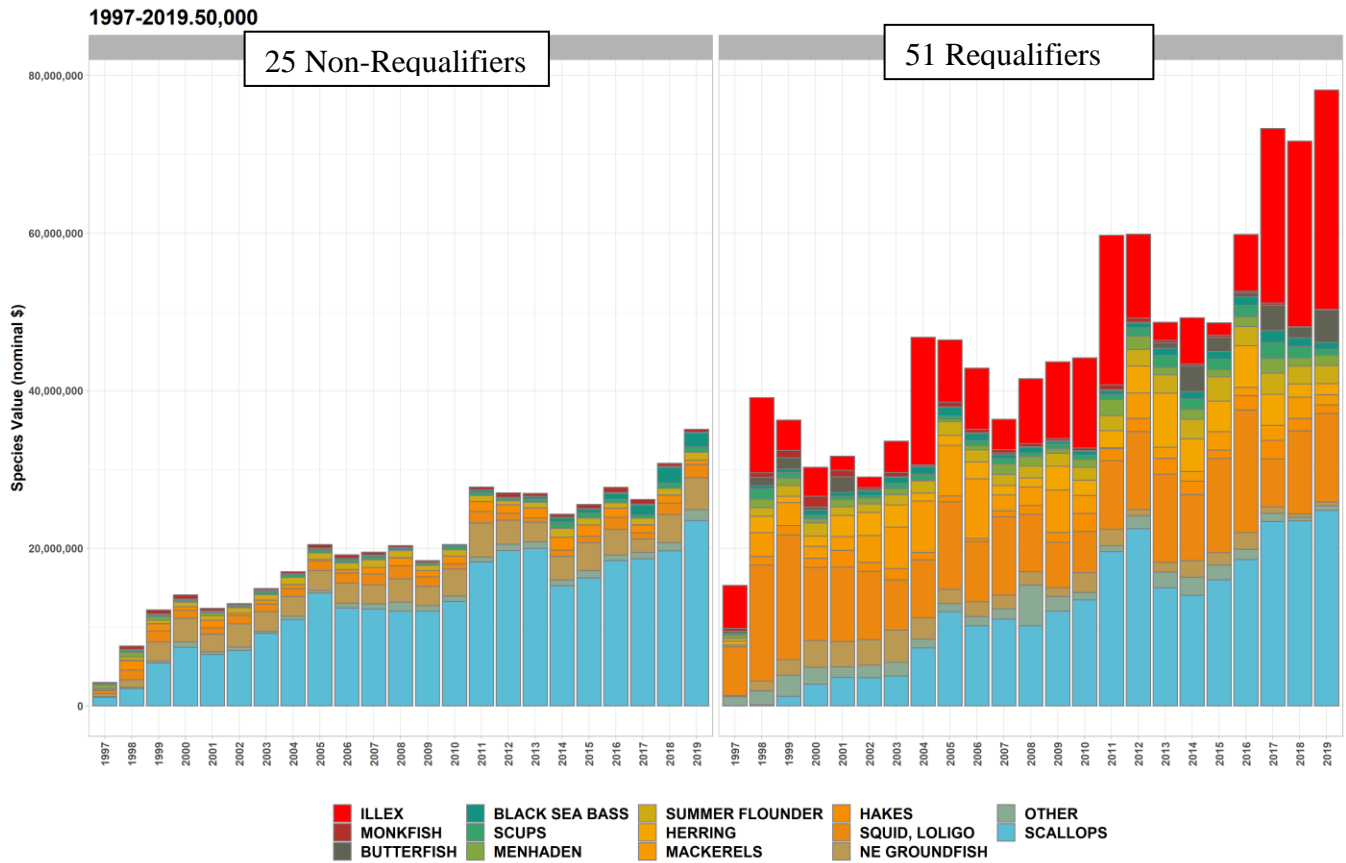
The figures in Appendix C build off of the revenue dependence to ask what species (*Illex* and others) make up MRIs' revenue portfolios when sorted into non-requalifying (left side) and requalifying (right side) groups for each of the 20 requalification criteria options. Several general conclusions can be made after reviewing the figures in Appendix C. As above, the same three options are provided immediately below, both to explain how to generally interpret the figures in Appendix C and because the general findings of the analysis aligns with these three examples. Again the three example illustrative time period/threshold options are: 1997-2019 with 50,000 pounds in any year (requalifies the most), 1997-2013 plus 2014-2019 with 1,000,000 pounds in one year in each (requalifies the least), and 1997-2013 with 300,000 pounds in any year (middle option).

The general result observable in Appendix C is that if more recent years are not used for requalification, or if higher thresholds are used, *Illex* contributes a greater portion of revenues for non-requalifiers, though still relatively low for most. Scallops are the dominant revenue source in recent years for non-requalifiers. Requalifiers have a relatively high contribution from *Illex* but other species make substantial contributions as well, including in recent years scallops, longfin squid, and butterfish. Appendix C can be consulted for each time period/threshold option to see more precisely how MRIs are affected under various options.

Revenues from other fisheries (this section) and possession of other permits (next section) provide information about fleet behavior generally and the capabilities to participate in other fisheries.

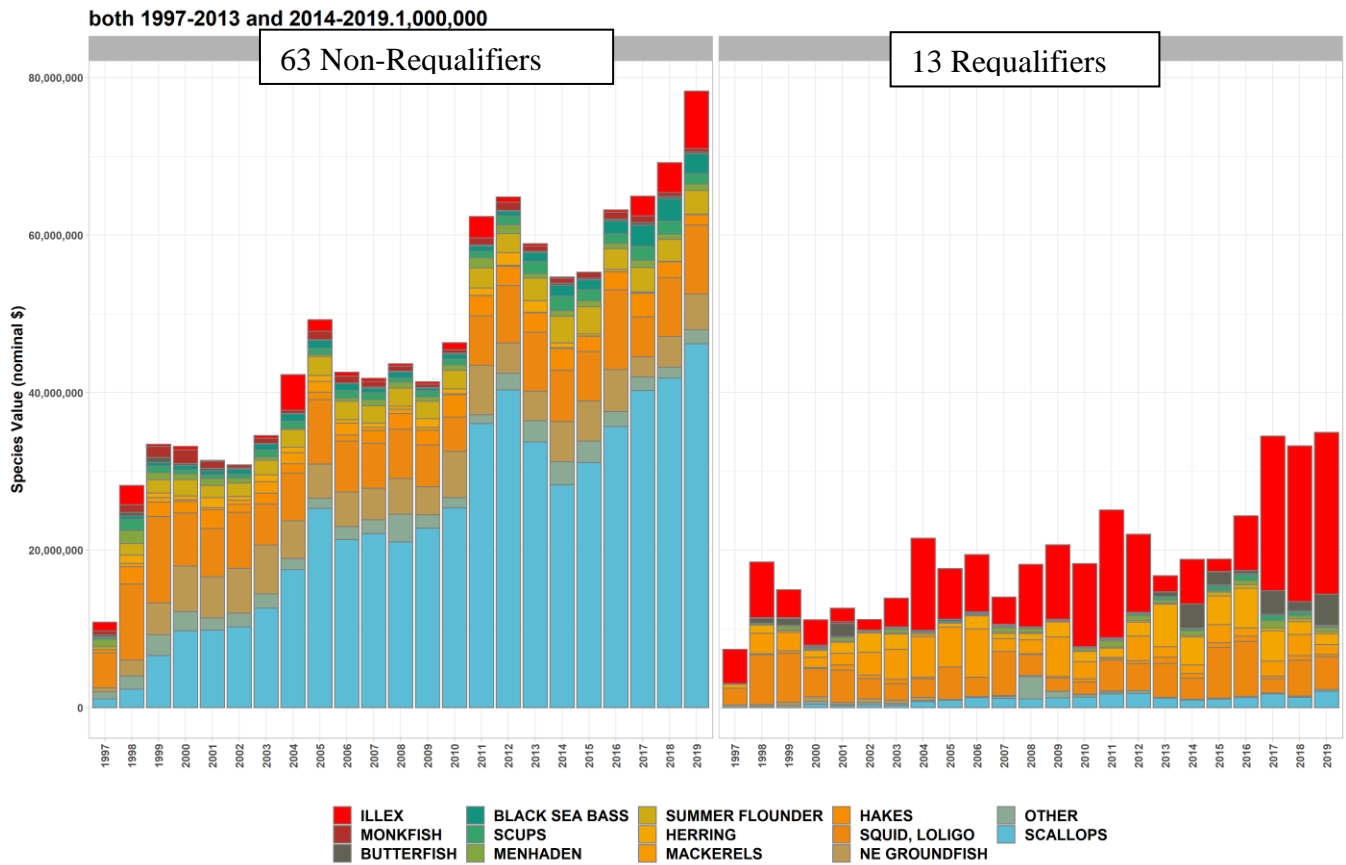
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Figure 18. Species revenues, by year, for the 1997-2019/50,000-pound option. Species in the top 10 for any year are included.



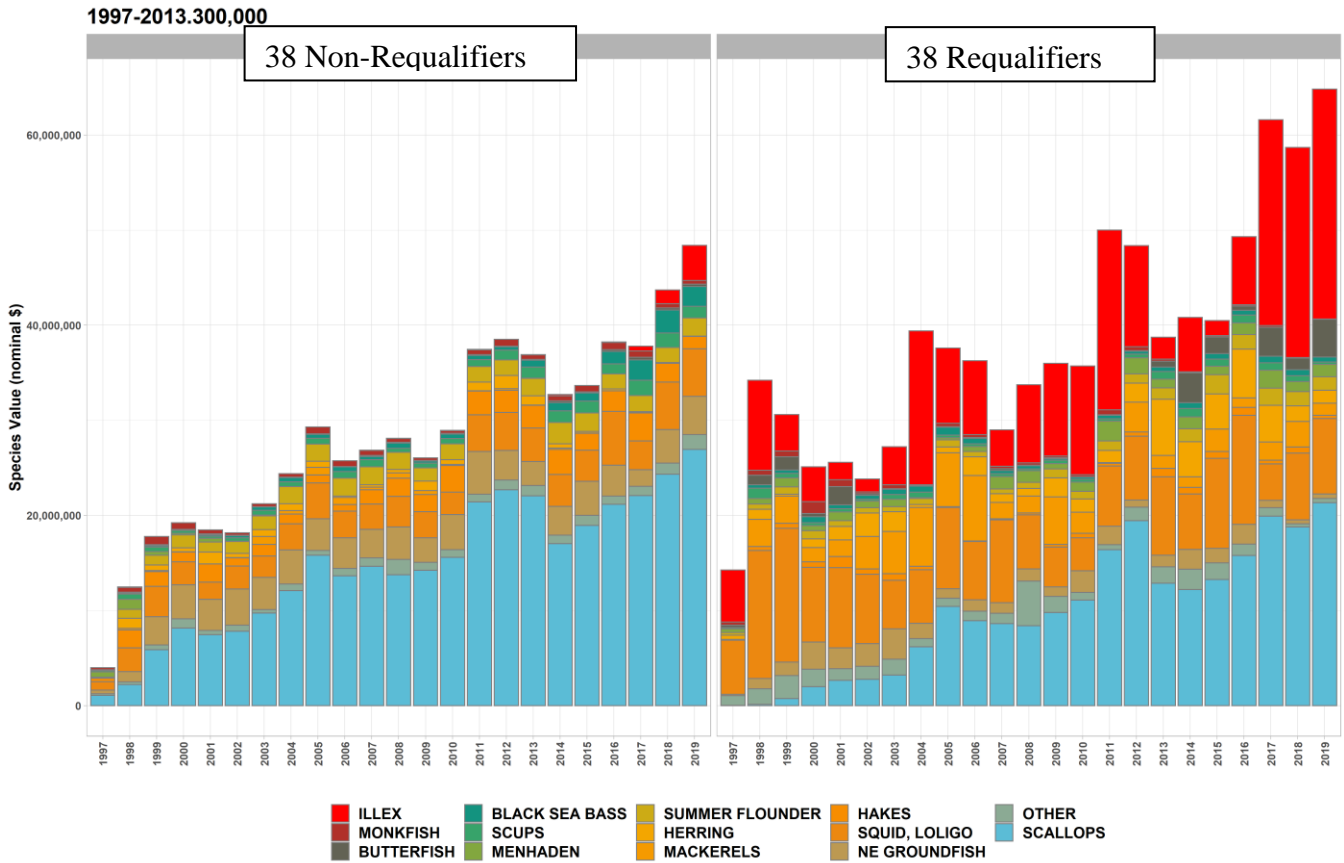
An immediate observation is that for the 1997-2019 50,000 pound option, non-requalifiers as a group have very little revenue from *Illex* (top red component), matching the MRI-level analysis in Appendix A. Most of their revenues in recent years came from scallops (bottom blue component). For qualifiers, in addition to *Illex*, scallops and longfin squid (middle orange component) are major contributions.

Figure 19. Species revenues, by year, for the 1997-2013 plus 2014-2019 with 1,000,000 pounds in one year in each period option. Species in the top 10 for any year are included.



For the 1997-2013 plus 2014-2019 with 1,000,000 pounds in one year in each option, the revenue distributions change. *Illex* contributes more for the non-requalifiers revenues as a group, but is still a relatively small portion. Scallops remain the dominant revenue source in recent years. For the few (13) requalifiers in this group, *Illex* frequently contributes more to total revenues than other individual species. For requalifiers, total revenues are lower as would be expected with so few MRIs in the requalifying group.

Figure 20. Species revenues, by year, for the 1997-2013/300,000-pound option. Species in the top 10 for any year are included.



For the 1997-2013 with 300,000 pounds in one year option, the revenue distributions change again. For non-requalifiers *Illex* revenues are in between the other two previous examples, and are still a relatively small portion. Scallops remain the dominant revenue source for non-requalifiers in recent years. For the requalifiers in this group, *Illex* is a major portion of revenues, with scallops, longfin squid, and butterfish also making substantial contributions.

Permits in Other Fisheries

Depending on the MRI and the MRI’s permit suite, possession of other permits may allow participation in other fisheries, which is a required consideration for limited access systems. The figures below provide information on permits that the FMAT determined might be most relevant – some permits such as spiny dogfish and tilefish have been omitted. Counts of MRIs that have the permit are shaded black, and counts of MRIs that do not have the permit are shaded grey. The figures in this section reflect the same three illustrative example time period/threshold options as above: first 1997-2019 with 50,000 pounds in any year (requalifies the most), then 1997-2013 plus 2014-2019 with 1,000,000 pounds in one year in each (requalifies the least), and finally 1997-2013 with 300,000 pounds in any year (middle option). Inactive permits currently in confirmation of permit history are not included in this analysis so not quite all 76 2019 *Illex* MRIs are included. Permit counts for all 20 requalification combinations are included in Appendix D.

Figure 21. Permits held by non-requalifying (left) and requalifying (right) MRIs for the 1997-2019/50,000-pound option.

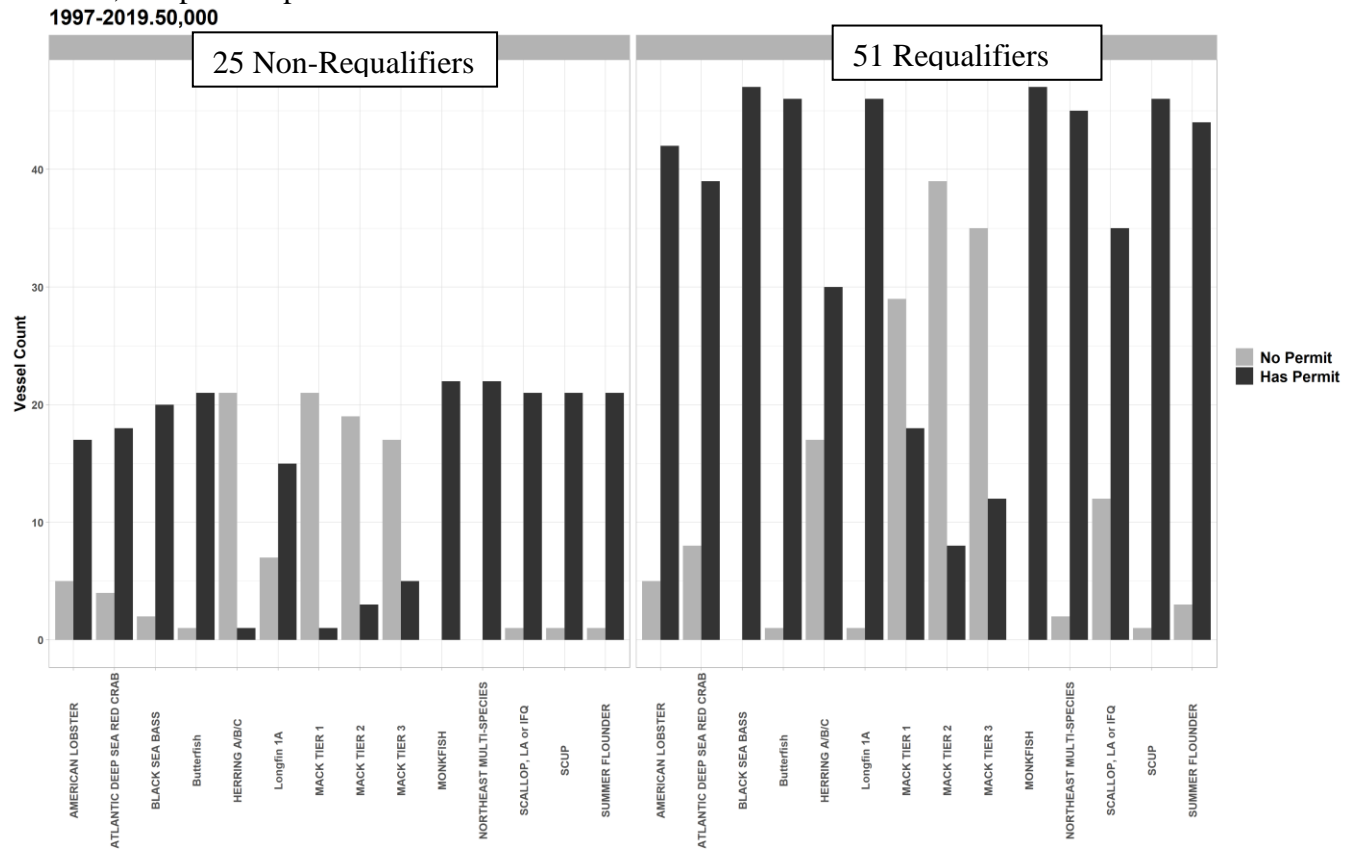
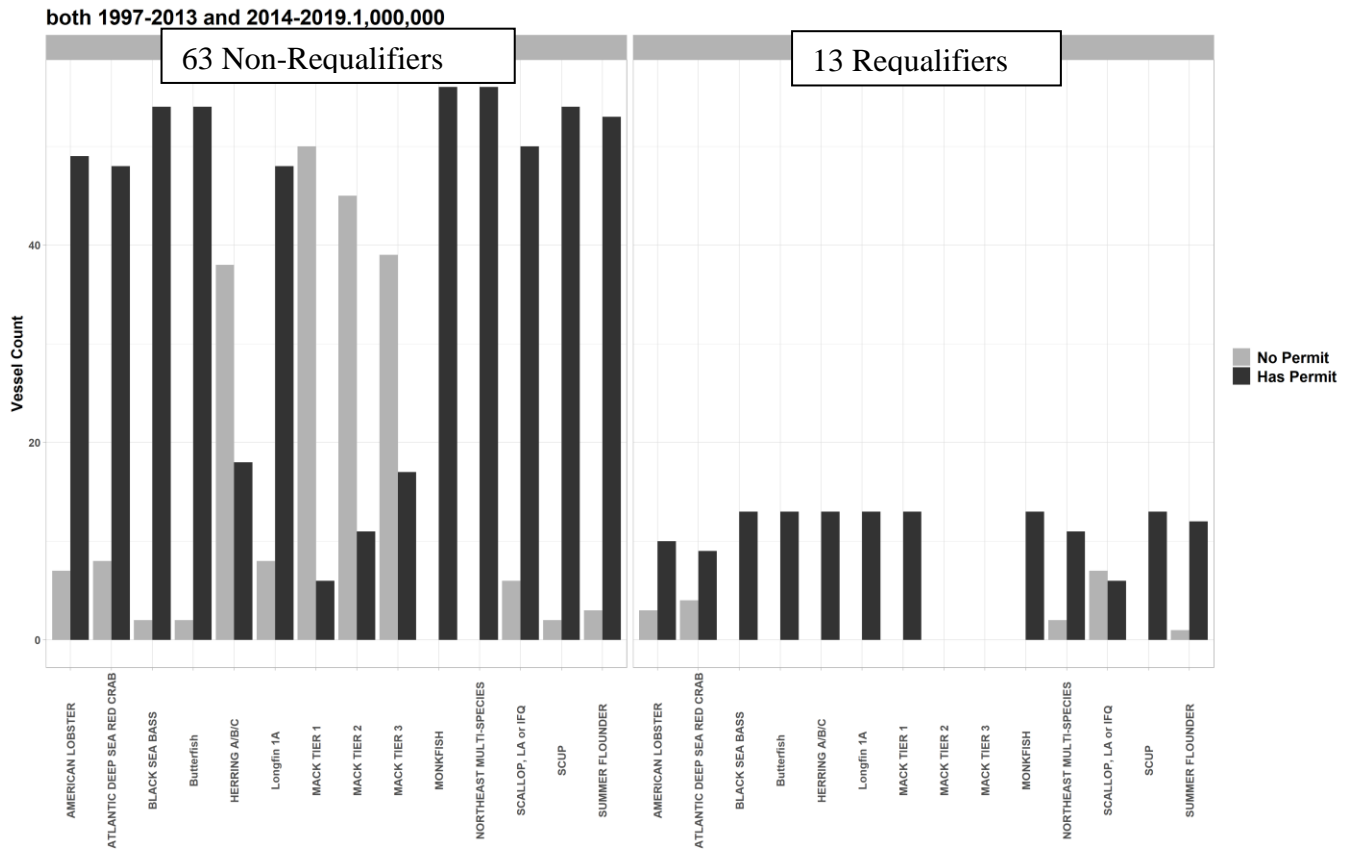
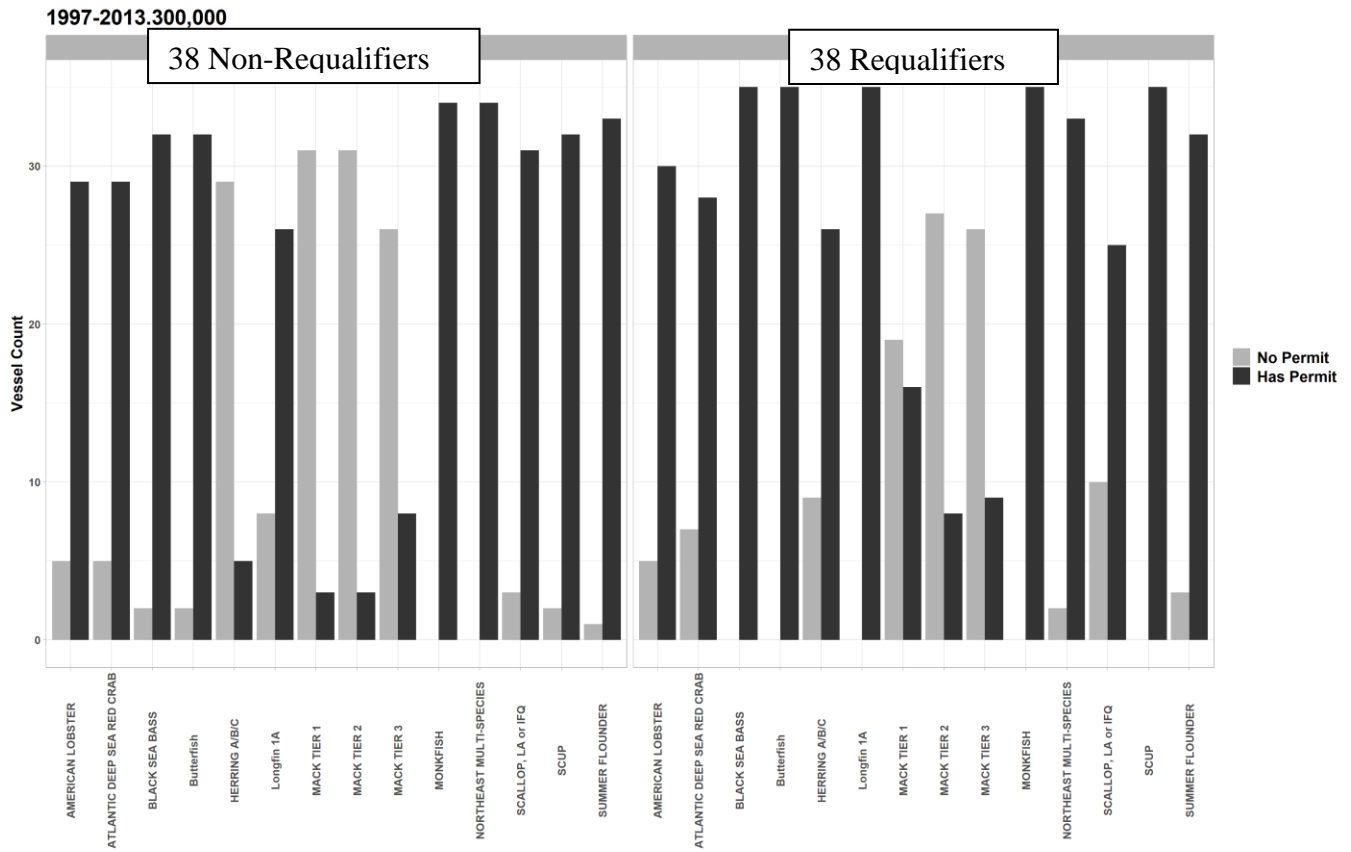


Figure 22. Permits held by non-requalifying (left) and requalifying (right) MRIs for the 1997-2013 plus 2014-2019 with 1,000,000 pounds in one year in each period option



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Figure 23. Permits held by non-requalifying (left) and requalifying (right) MRIs for the 1997-2013/300,000-pound option.



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Impacts

With an understanding of qualification and participation, several likely conclusions can be made regarding the impacts from the alternatives. Impacts will be analyzed in more detail in an environmental assessment which will be finalized in accordance with the National Environmental Policy Act after the Council selects preferred alternatives (tentatively scheduled for June 2020) but before additional public comment on any proposed rule.

Biological Impacts on the *Illex* Stock

Requalification alternatives (Sets A and B) will impact the number of MRIs that have access to the *Illex* squid fishery, in varying degrees. Since the resulting fleet will likely still have the capacity to harvest the full *Illex* quota in a manner similar to previous years when fishing is good, these alternatives are not likely to substantively change the amount or character of overall *Illex* fishing effort. However, since further racing to fish should be mitigated to some degree by reducing recent/additional activation of latent effort, requalification alternatives could help closures occur in a timely fashion to the degree they reduce participants and avoid even faster landings. There could thus be a positive impact to the *Illex* squid resource condition from being able to more effectively close the fishery before quota overages occur, but the impact is low positive due to the limited and indirect nature of the impact (with quota management, overages should be slight in most years).

If the trip limits provided for non-requalifying MRIs allow them to substantially increase effort compared to recent activity, then the goal of avoiding increase in racing to fish (and indirectly avoiding quota overages) may be subverted. Accordingly, higher trip limits for non-requalifying MRIs may have negative impacts compared to only allowing non-requalifying MRIs to obtain an incidental permit, but the impact is low negative due to the limited and indirect nature of the impact.

The hold measurement/upgrade restrictions, in combination with permit requalification, should help to slow additional capacity development in this fishery, reducing additional racing to fish. There would thus be a positive impact to the *Illex* squid resource condition from being able to more effectively close the fishery before quota overages occur, and the impact is low positive due to the limited and indirect nature of the impact. Clarifying that daily VMS reporting of *Illex* is required should have a positive impact on the *Illex* squid resource condition from collecting additional information to more accurately estimate catch rates and more effectively close the fishery before quota overages occur.

Economic Impacts

Requalification alternatives (Sets A and B) will impact the number of vessels that have access to the *Illex* squid fishery, in varying degrees. Since the resulting fleet will likely still have the capacity to harvest the full *Illex* quota in a manner similar to previous years when fishing is good, these alternatives are not likely to substantively change the amount of overall ex-vessel revenues from *Illex* fishing. During slower fishing years, eliminating the more recently active MRIs may somewhat reduce total landings (less vessels out looking for *Illex*), but it is not possible to determine by how much, since participation will broadly change during slower fishing years.

Alternatives that eliminate or reduce access for recent or additional entrants could have a positive impact on re-qualifiers because they would have more secure access to the squid quota and the value of their permit would likely increase. While the non-qualifying MRIs have generally not landed a large proportion of *Illex* historically, with more restrictive alternative combinations some individual non-qualifying MRIs have derived a substantial portion of their revenues from *Illex* in recent years, especially during 2017-2019. These MRIs would have a negative impact compared to their recent performance, and would also lose the value of their permit itself. It is not clear what the current value of an *Illex* permit with low catch history is currently, since to some degree catch history is factored into permit values, and permit trading entities have been aware that requalification is on the table for *Illex* (Council staff receives periodic calls from individuals and entities involved in the buying and selling of permits, requesting information on the status of this action).

If the trip limits provided for non-requalifying MRIs allow them to increase or maintain recent effort, then impacts on them would be mitigated, but then less quota would be available for the other requalified MRIs.

The hold measurement/upgrade restrictions have associated costs. Informal contacts by council staff with a few marine surveyors revealed that a fish hold measurement could run approximately \$10-\$80 per foot of vessel length, which could range from as low as \$750 for a 75 foot vessel to as high as \$12,000 for a 150 foot vessel, depending on the surveyor, the boat design, and travel expenses. To the extent that surveys are already required for insurance purposes these costs may be already part of a vessel's operating costs, and many of the *Illex* permitted vessels already have hold documentation due to their mackerel permits.

All limited access permitted *Illex* vessels must already use VMS and many already report their daily *Illex* catches via VMS. Accordingly, costs for clarifying that daily *Illex* catches must be reported via VMS should be minimal.

Safety at Sea Impacts

Racing to fish can have negative impacts on safety at sea related to weather, deferred maintenance, and overloading. Requalification alternatives (Sets A and B) may impact the number of MRIs that have access to the *Illex* squid fishery, in varying degrees. Since exacerbation of racing to fish should be mitigated to some degree by reducing recent/additional activation of latent effort, requalification alternatives should benefit safety at sea to the degree they reduce participants. If the trip limits provided for non-requalifying MRIs allow them to substantially increase effort, then the goal of avoiding increase in racing to fish may be subverted. It is not anticipated that other alternatives would affect safety at sea.

Community Impacts

The Council is also concerned about impacts to communities if re-activated permits rapidly change the distribution of landings at relevant ports in communities that have dependence on *Illex*. Based on Table 4, only in North Kingston, RI and Cape May, NJ are *Illex* revenues a sustained and substantial portion of port revenues, with North Kingston substantially more dependent on *Illex* than any other port. While Cape May, NJ has less reliance on *Illex*, according to NMFS' Social Indicators for Fishing Communities, Cape May has relatively higher vulnerability scores (see Figures 9 to 14). Based on these findings, both North Kingston, RI and Cape May, NJ seem potentially disproportionately impacted by disruption or rapid change in the *Illex* fishery.

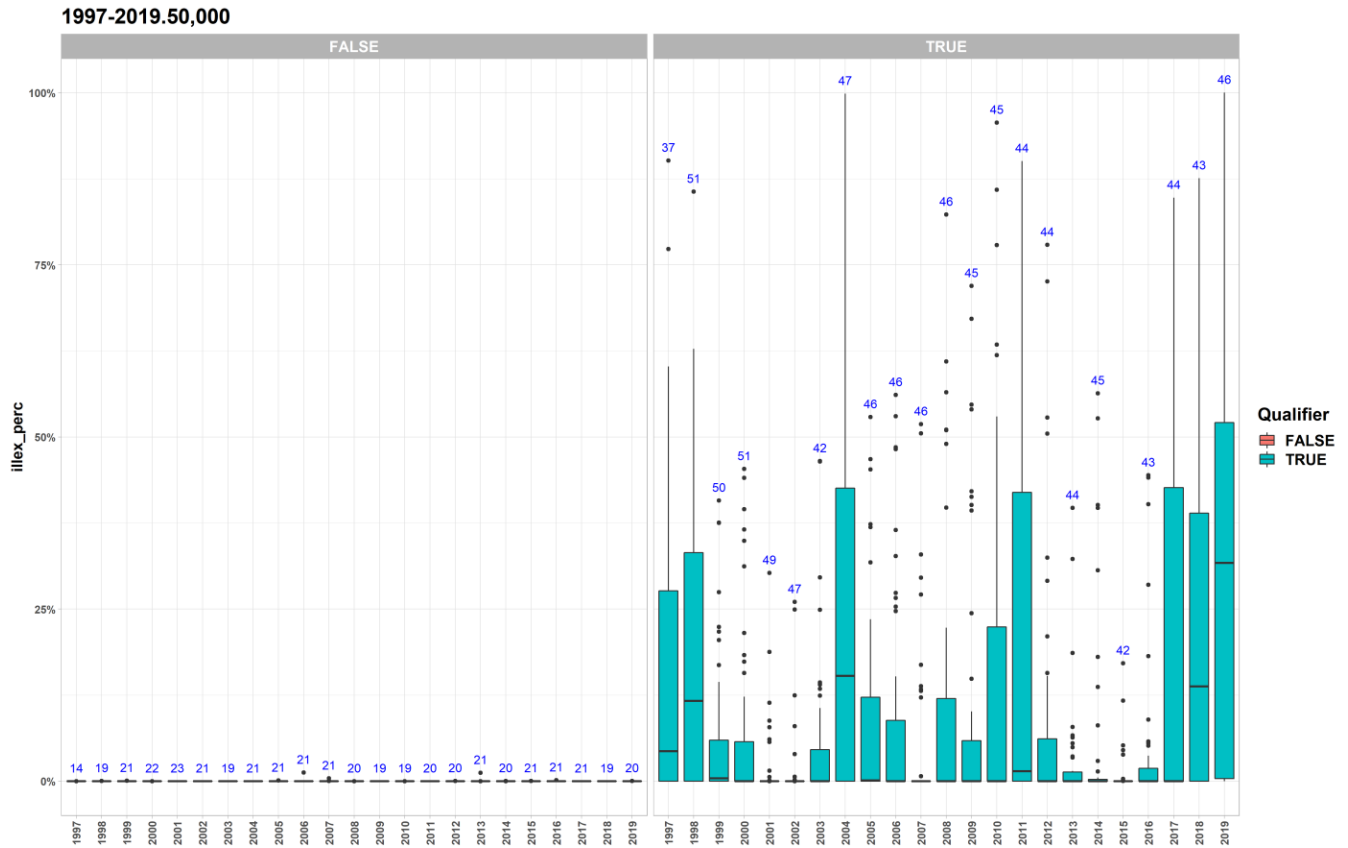
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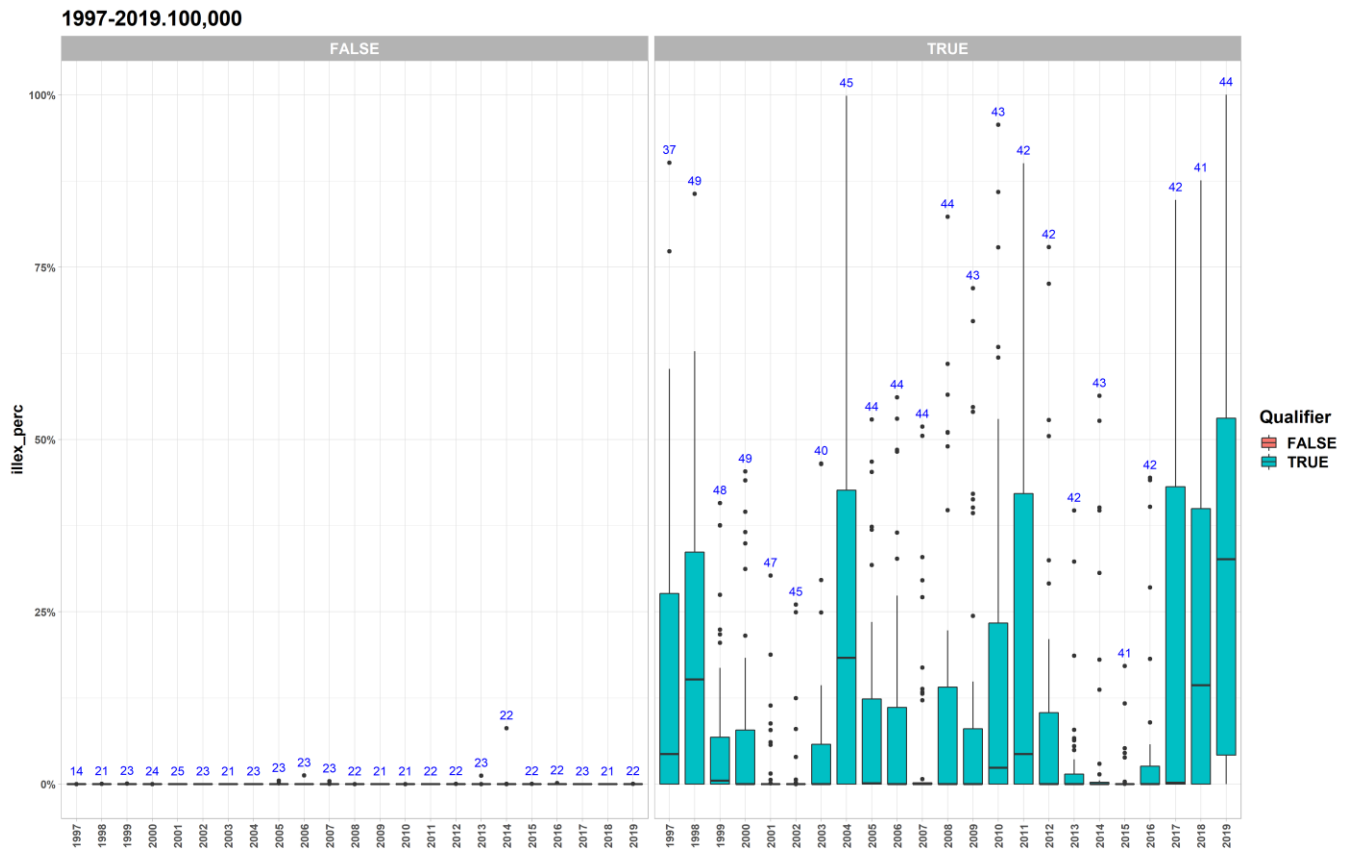
Appendix A. Boxplots of Dependence on *Illex* (Revenues) for Requalification Options

Figure A1. 1997-2019/50K Option Dependencies.



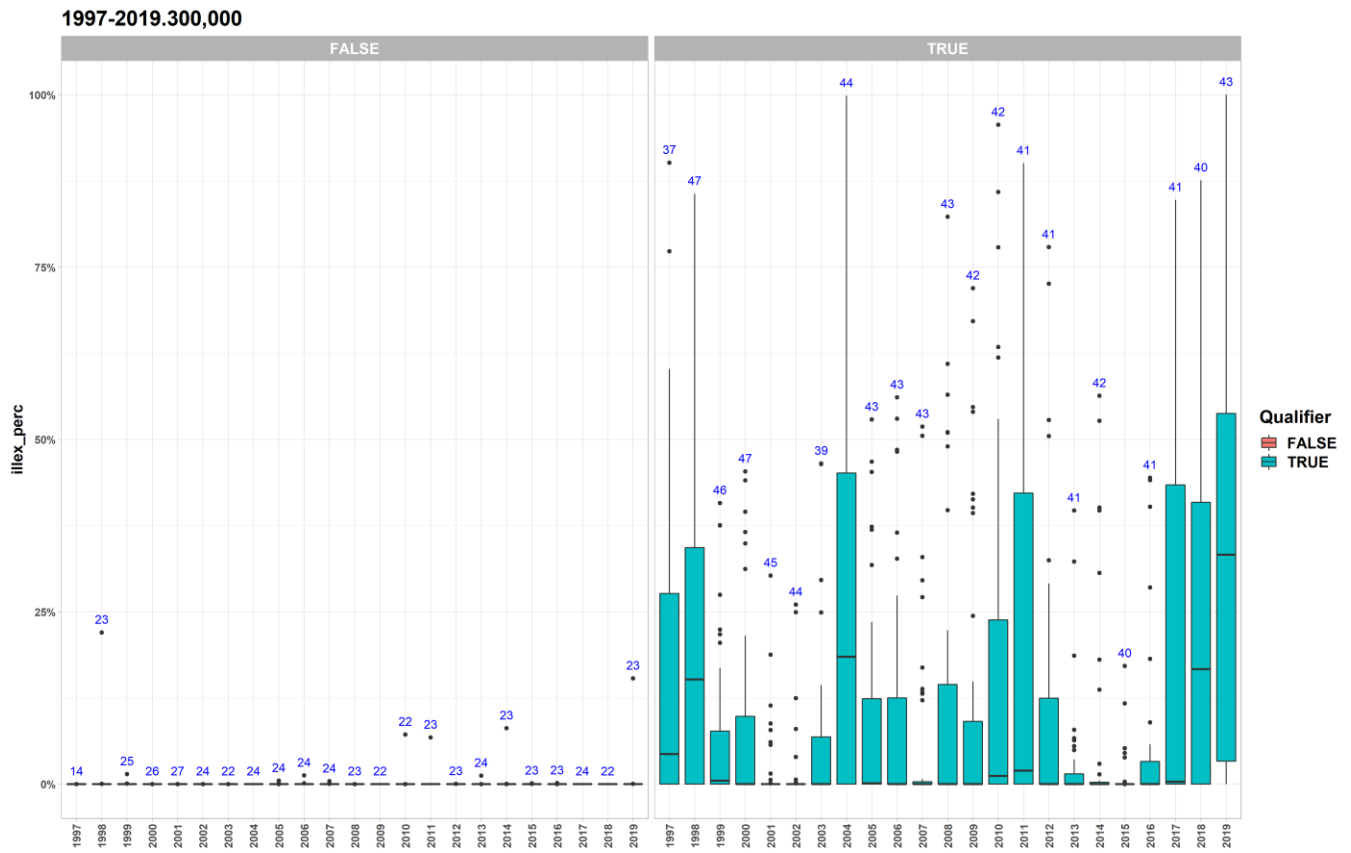
Bar is the interquartile (middle) range (IQR); black line is the median; vertical lines extend to observations near 1.5 * IQR; outliers are dots. “False” = Non-Requalifiers (on left); “True” = Requalifiers (on right)

Figure A2. 1997-2019/100K Option Dependencies.



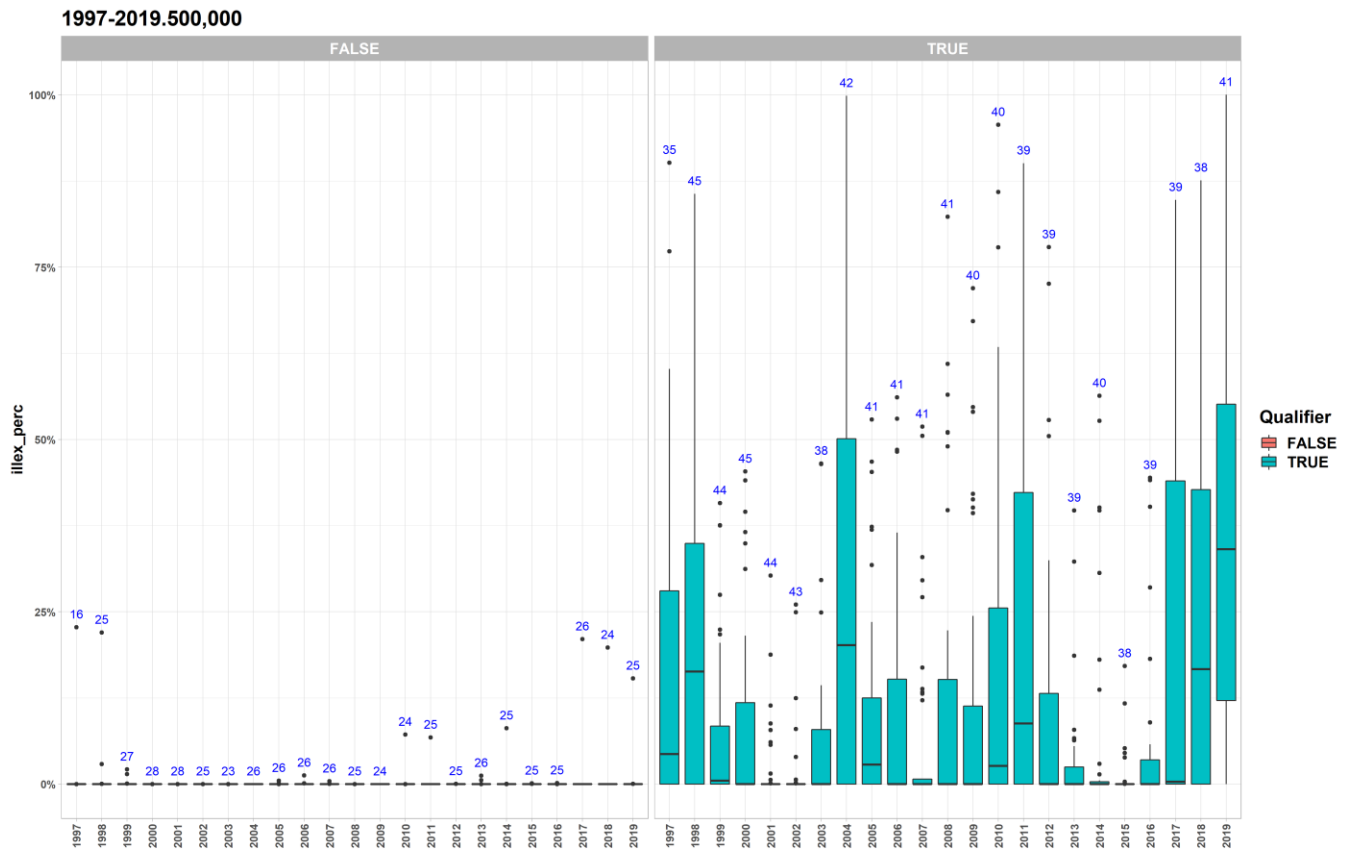
Bar is the interquartile (middle) range (IQR); black line is the median; vertical lines extend to observations near 1.5 * IQR; outliers are dots. “False” = Non-Requalifiers (on left); “True” = Requalifiers (on right)

Figure A3. 1997-2019/300K Option Dependencies.



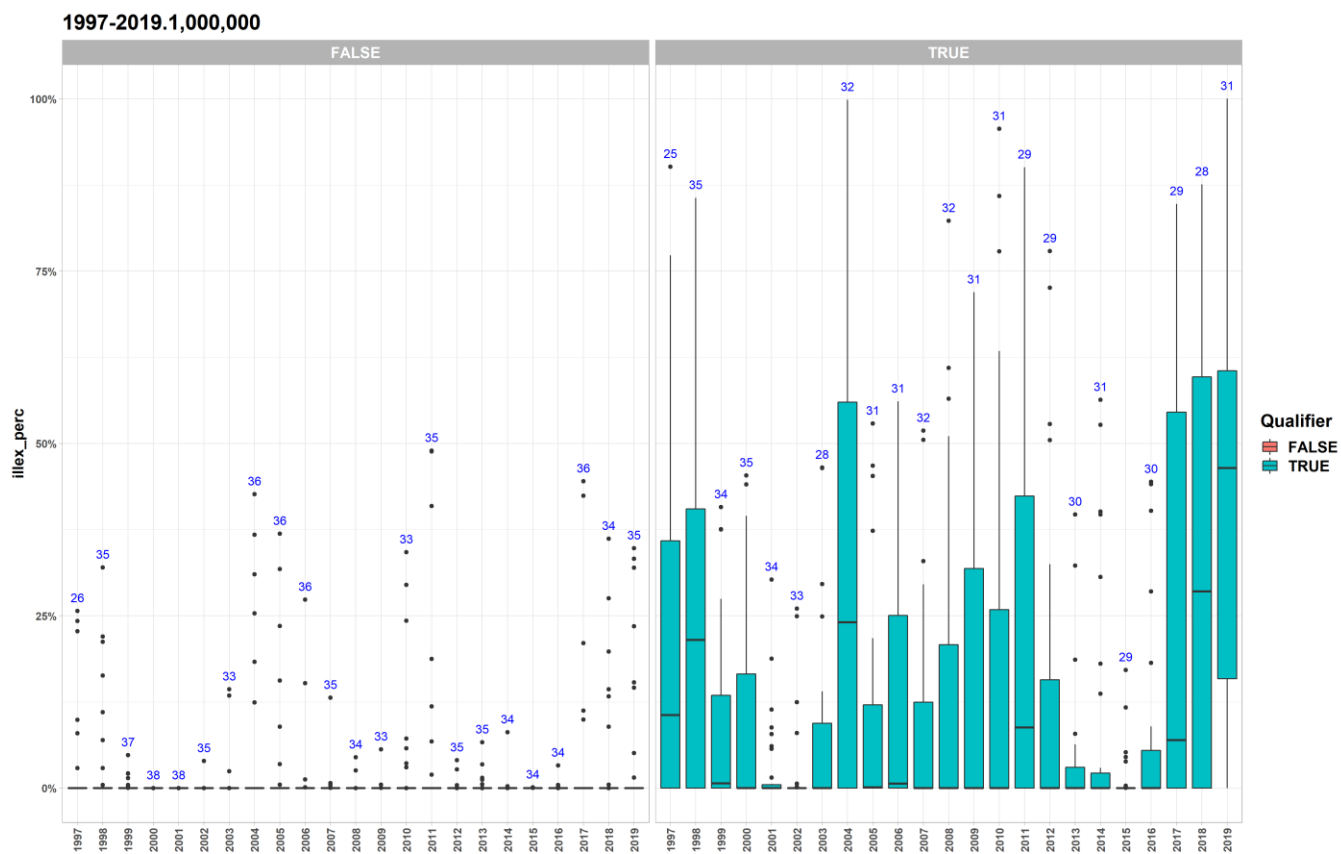
Bar is the interquartile (middle) range (IQR); black line is the median; vertical lines extend to observations near 1.5 * IQR; outliers are dots. “False” = Non-Requalifiers (on left); “True” = Requalifiers (on right)

Figure A4. 1997-2019/500K Option Dependencies.



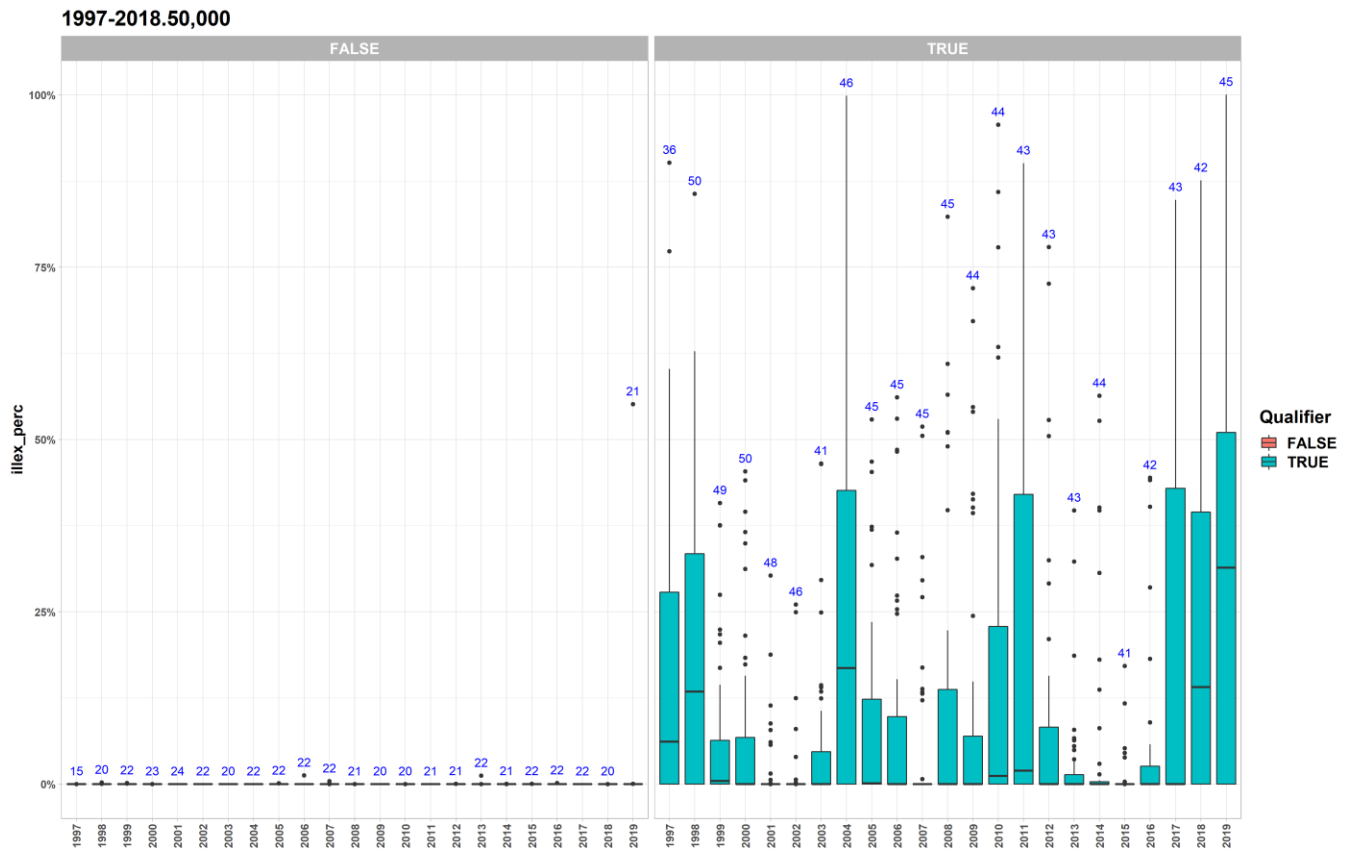
Bar is the interquartile (middle) range (IQR); black line is the median; vertical lines extend to observations near 1.5 * IQR; outliers are dots. “False” = Non-Requalifiers (on left); “True” = Requalifiers (on right)

Figure A5. 1997-2019/1,000,000 Option Dependencies.



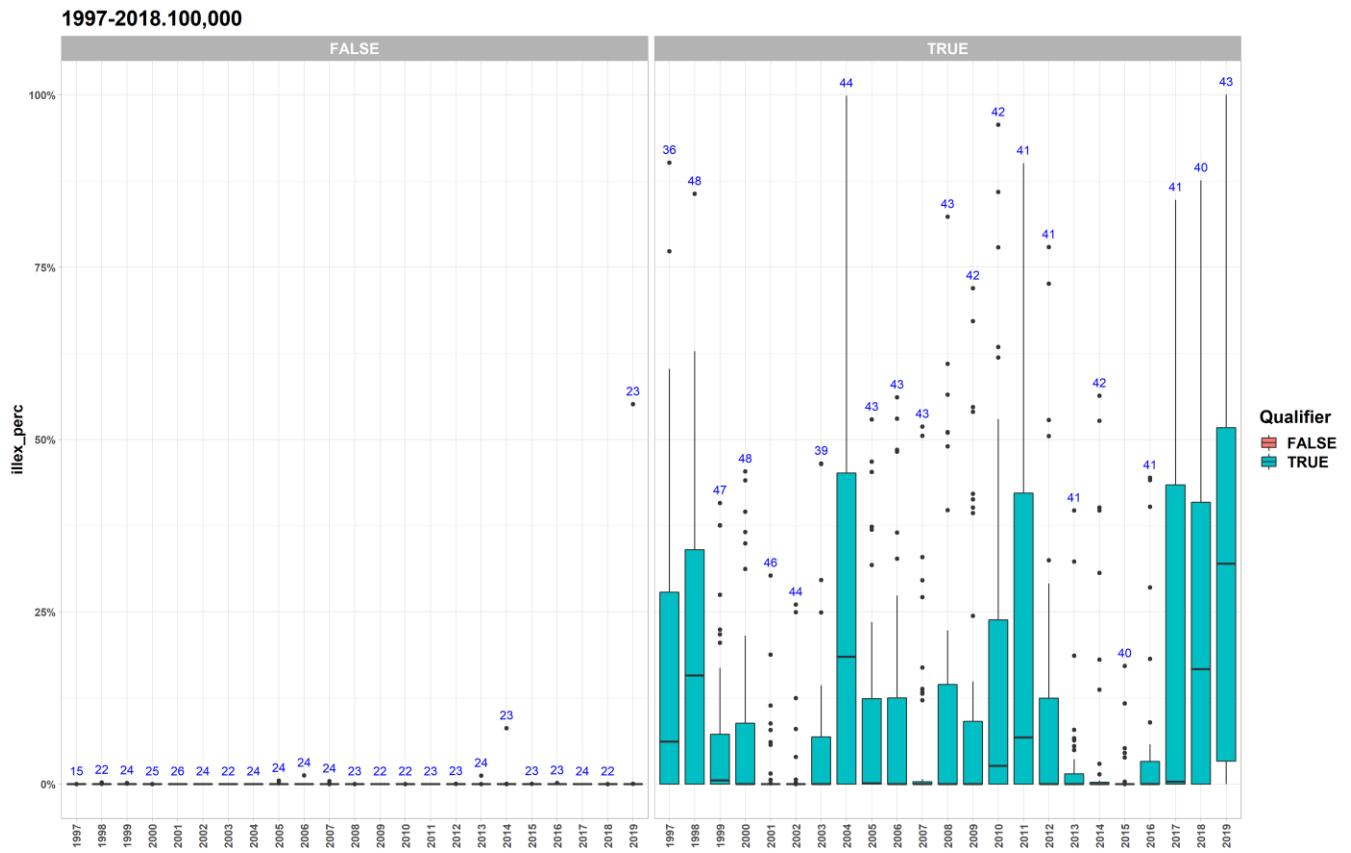
Bar is the interquartile (middle) range (IQR); black line is the median; vertical lines extend to observations near 1.5 * IQR; outliers are dots. “False” = Non-Requalifiers (on left); “True” = Requalifiers (on right)

Figure A6. 1997-2018/50K Option Dependencies.



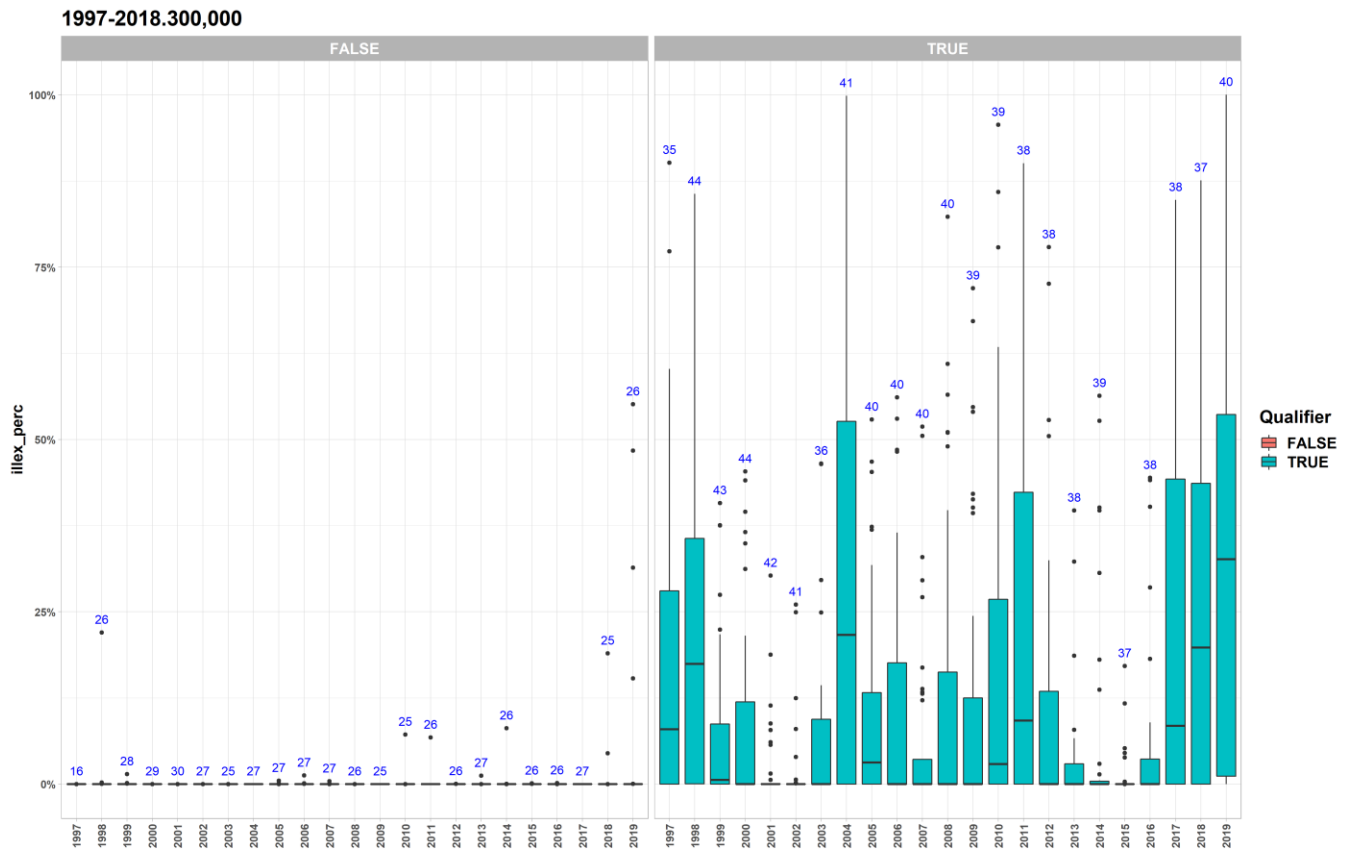
Bar is the interquartile (middle) range (IQR); black line is the median; vertical lines extend to observations near 1.5 * IQR; outliers are dots. “False” = Non-Requalifiers (on left); “True” = Requalifiers (on right)

Figure A7. 1997-2018/100K Option Dependencies.



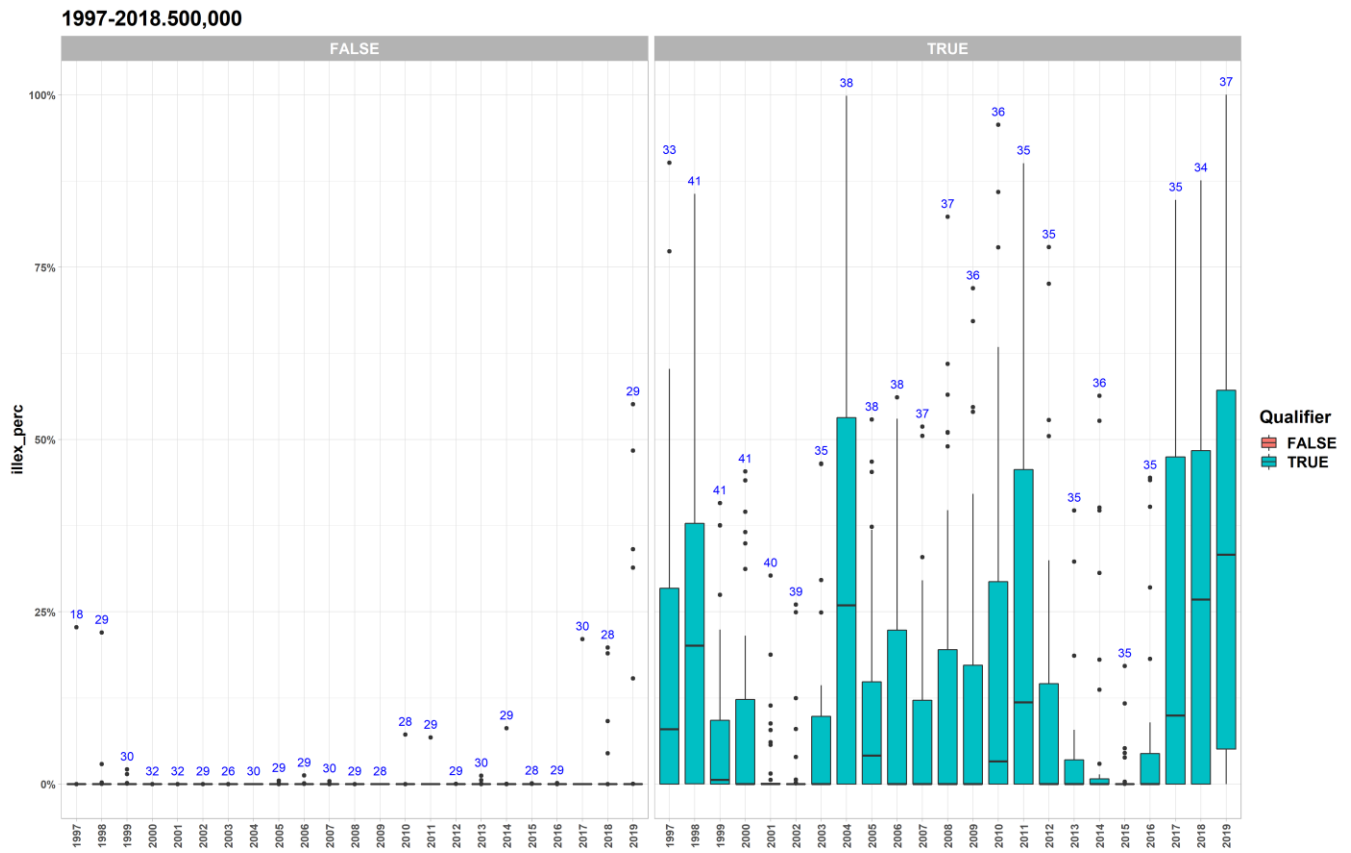
Bar is the interquartile (middle) range (IQR); black line is the median; vertical lines extend to observations near 1.5 * IQR; outliers are dots. “False” = Non-Requalifiers (on left); “True” = Requalifiers (on right)

Figure A8. 1997-2018/300K Trip Option Dependencies.



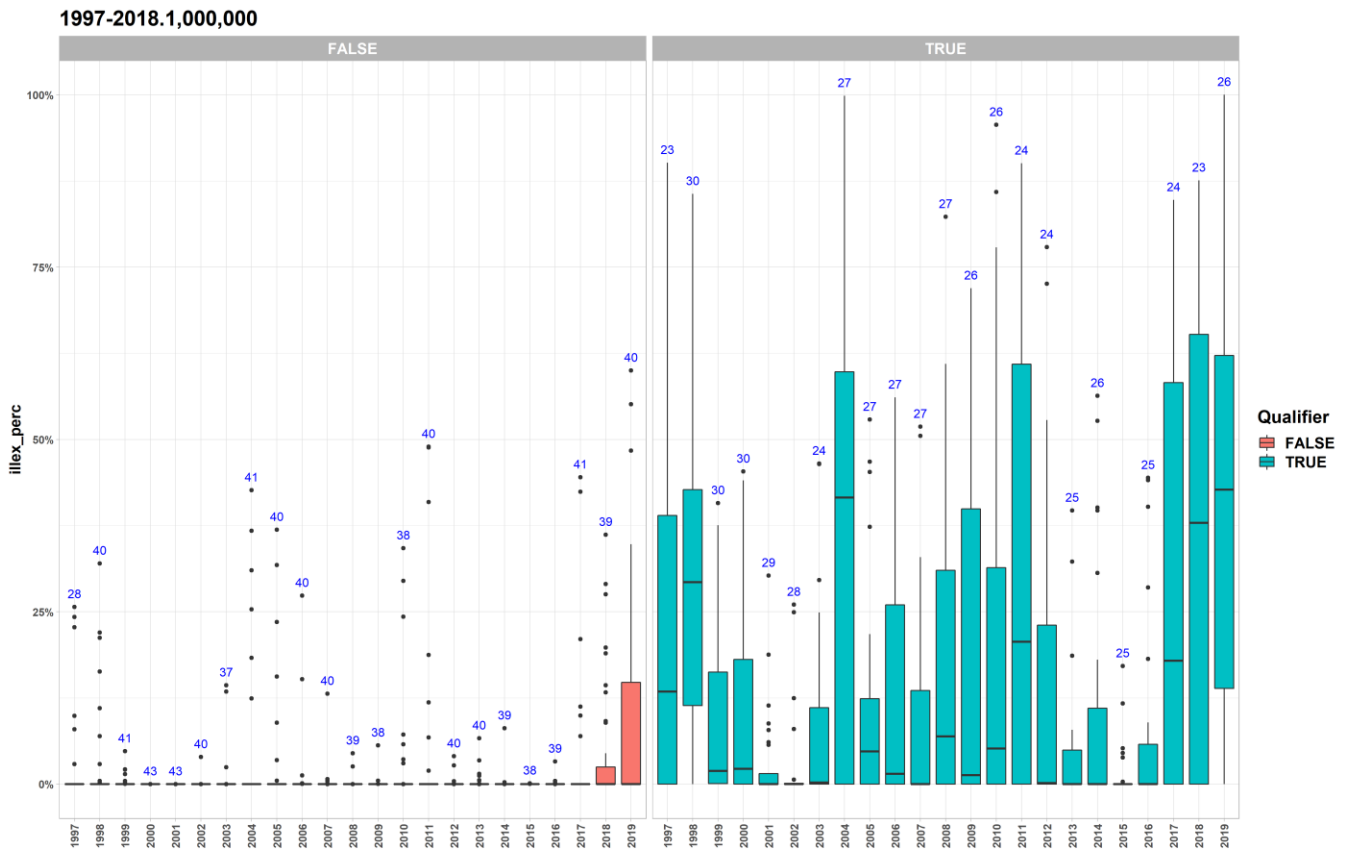
Bar is the interquartile (middle) range (IQR); black line is the median; vertical lines extend to observations near 1.5 * IQR; outliers are dots. “False” = Non-Requalifiers (on left); “True” = Requalifiers (on right)

Figure A9. 1997-2018/500K Option Dependencies.



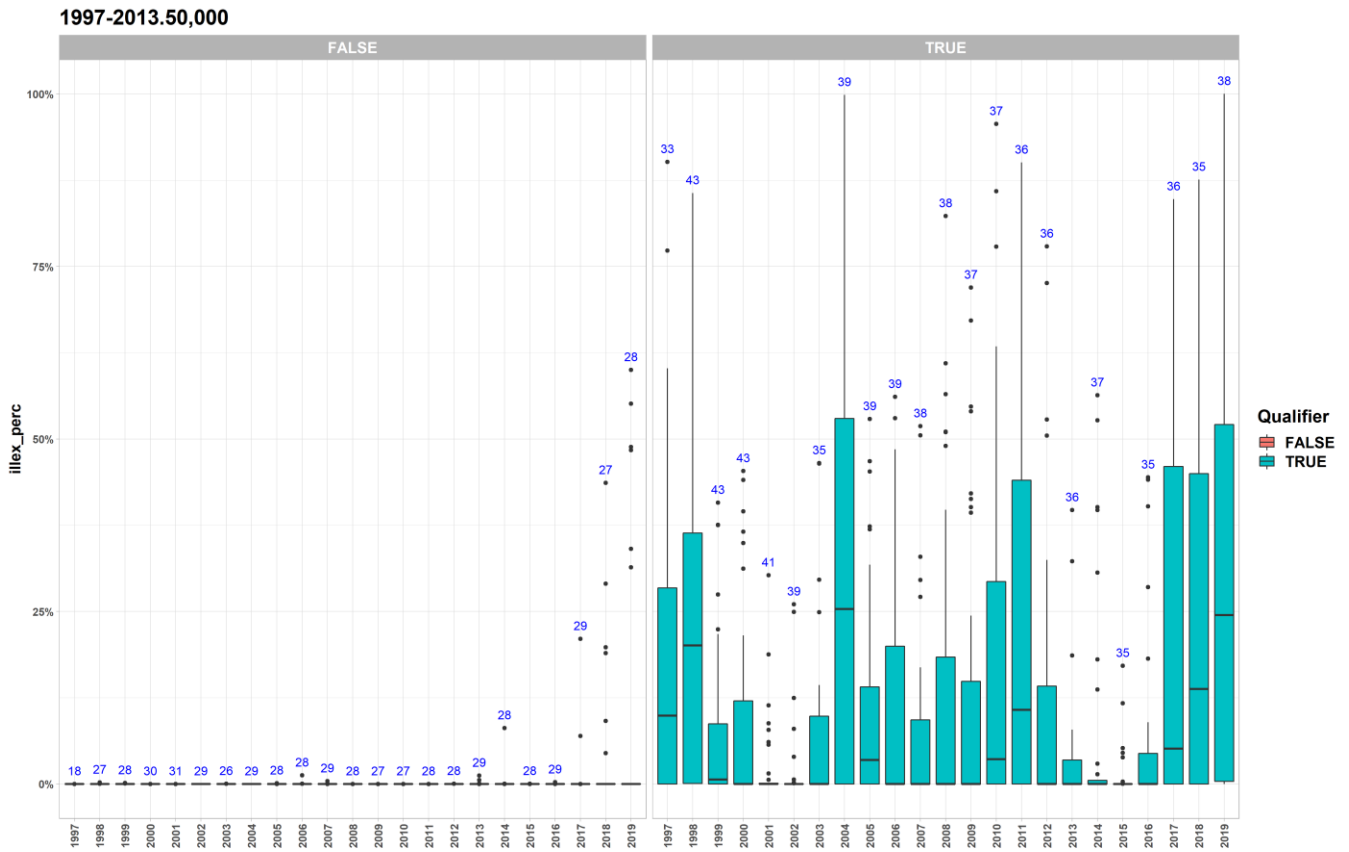
Bar is the interquartile (middle) range (IQR); black line is the median; vertical lines extend to observations near 1.5 * IQR; outliers are dots. “False” = Non-Requalifiers (on left); “True” = Requalifiers (on right)

Figure A10. 1997-2018/1,000,000 Option Dependencies.



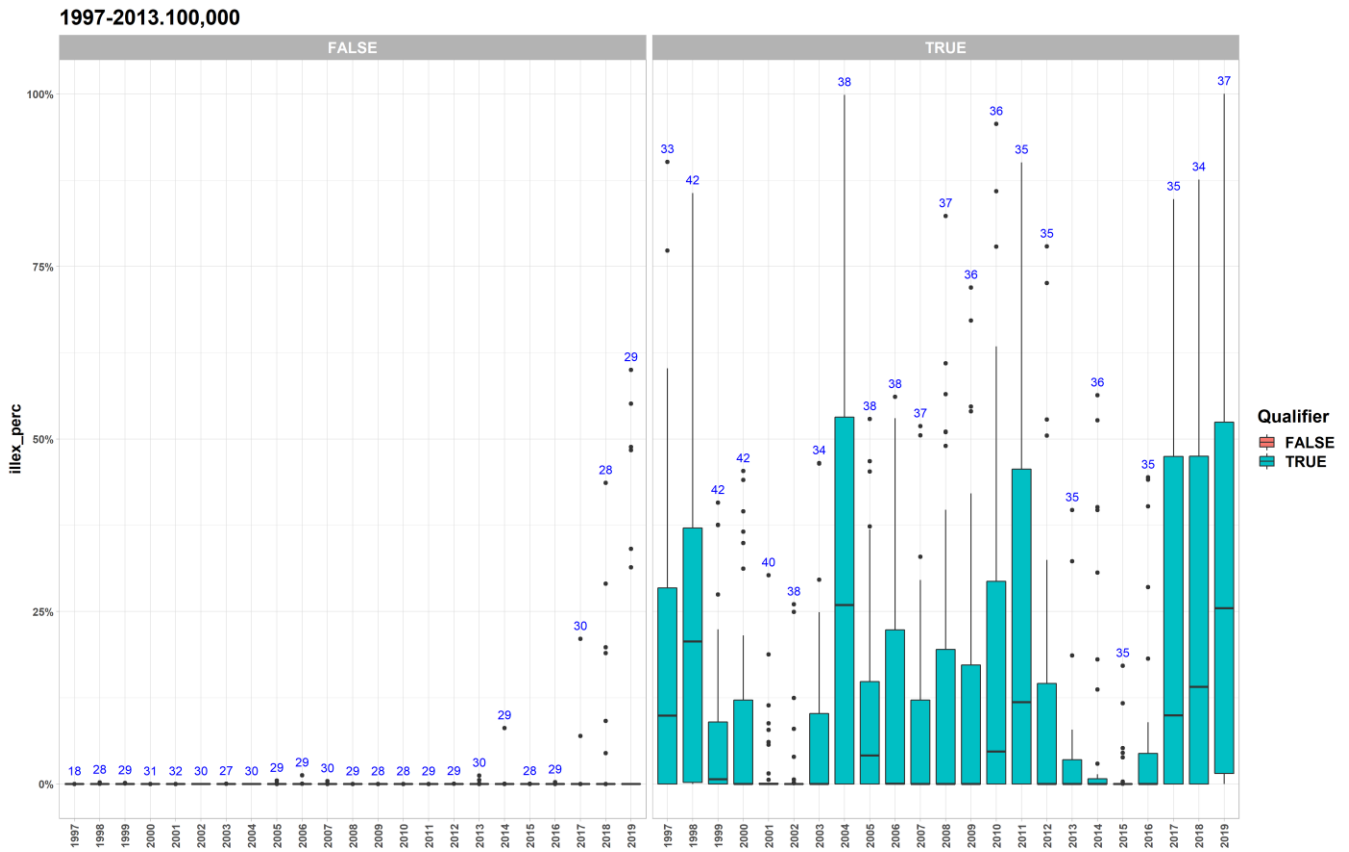
Bar is the interquartile (middle) range (IQR); black line is the median; vertical lines extend to observations near 1.5 * IQR; outliers are dots. “False” = Non-Requalifiers (on left); “True” = Requalifiers (on right)

Figure A11. 1997-2013/50K Option Dependencies.



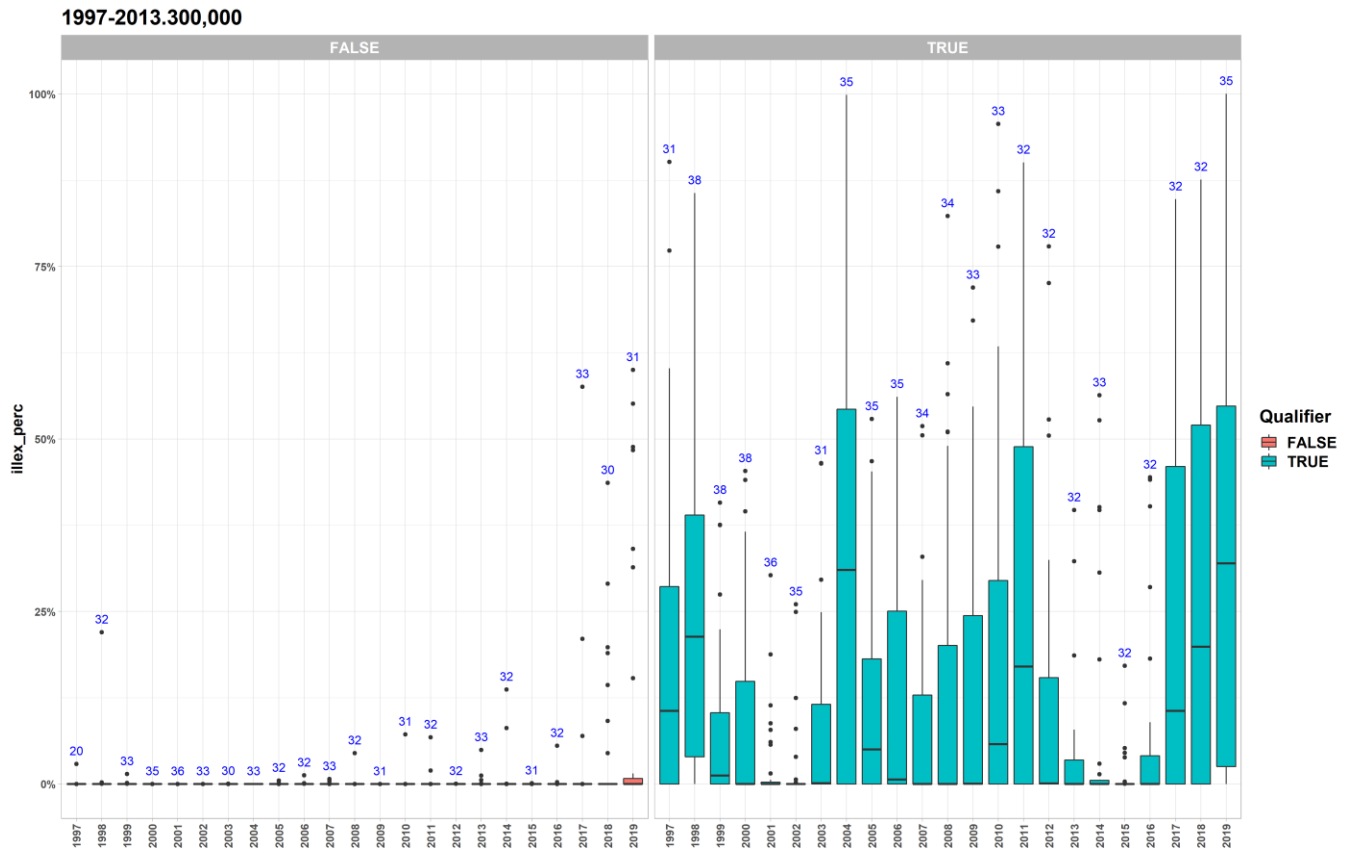
Bar is the interquartile (middle) range (IQR); black line is the median; vertical lines extend to observations near 1.5 * IQR; outliers are dots. “False” = Non-Requalifiers (on left); “True” = Requalifiers (on right)

Figure A12. 1997-2013/100K Option Dependencies.



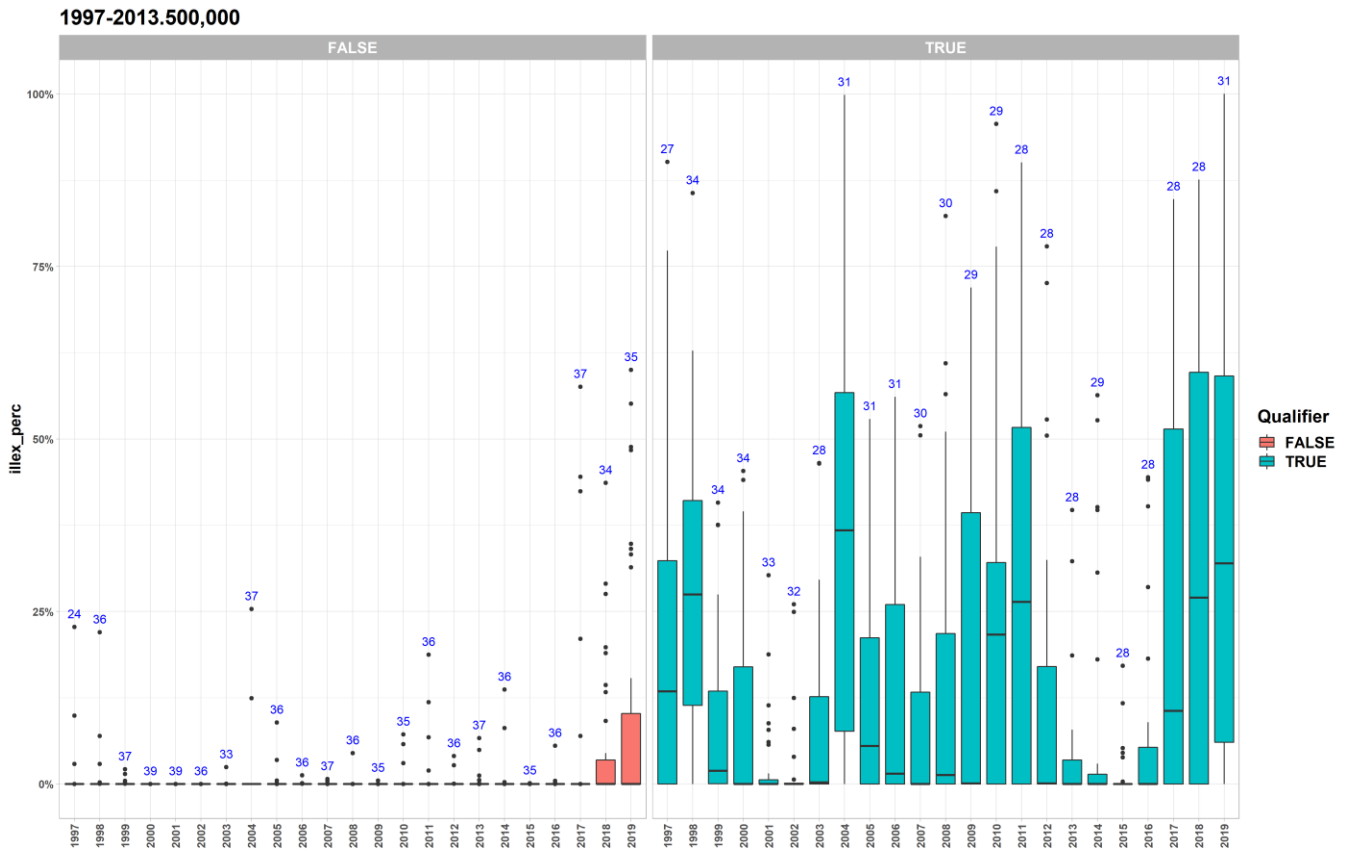
Bar is the interquartile (middle) range (IQR); black line is the median; vertical lines extend to observations near 1.5 * IQR; outliers are dots. “False” = Non-Requalifiers (on left); “True” = Requalifiers (on right)

Figure A13. 1997-2013/300K Option Dependencies.



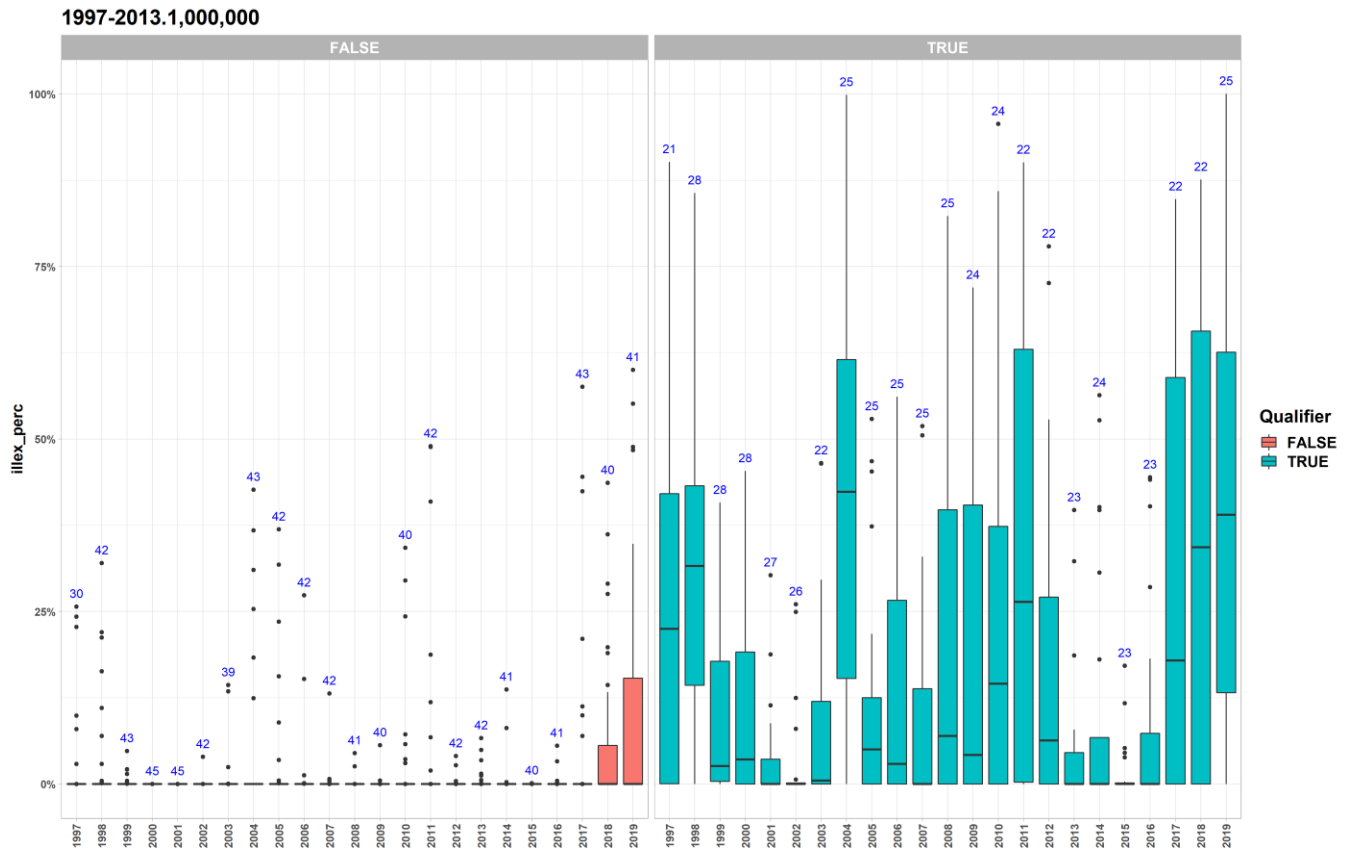
Bar is the interquartile (middle) range (IQR); black line is the median; vertical lines extend to observations near 1.5 * IQR; outliers are dots. “False” = Non-Requalifiers (on left); “True” = Requalifiers (on right)

Figure A14. 1997-2013/500K Option Dependencies.



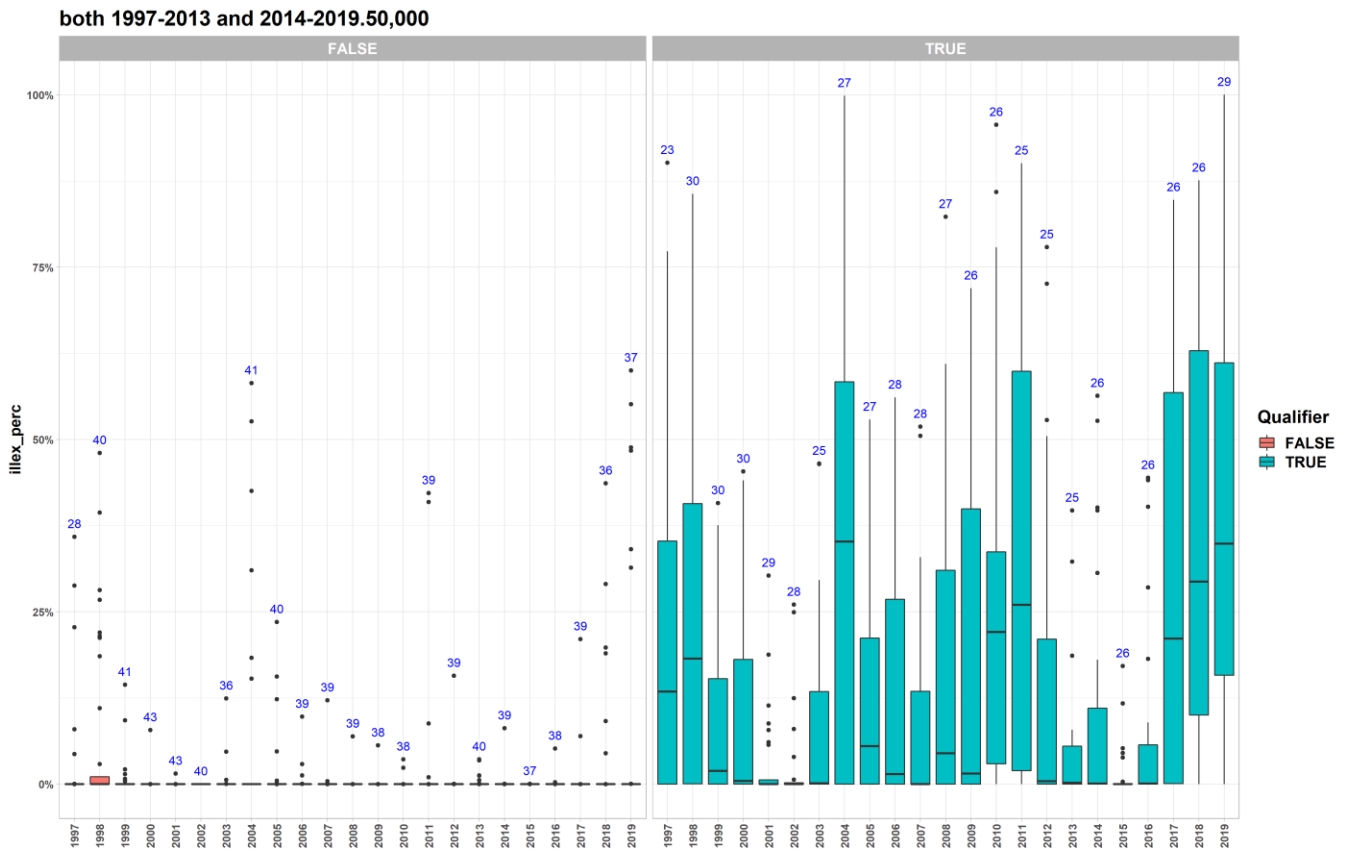
Bar is the interquartile (middle) range (IQR); black line is the median; vertical lines extend to observations near 1.5 * IQR; outliers are dots. “False” = Non-Requalifiers (on left); “True” = Requalifiers (on right)

Figure A15. 1997-2013/1,000,000 Option Dependencies.



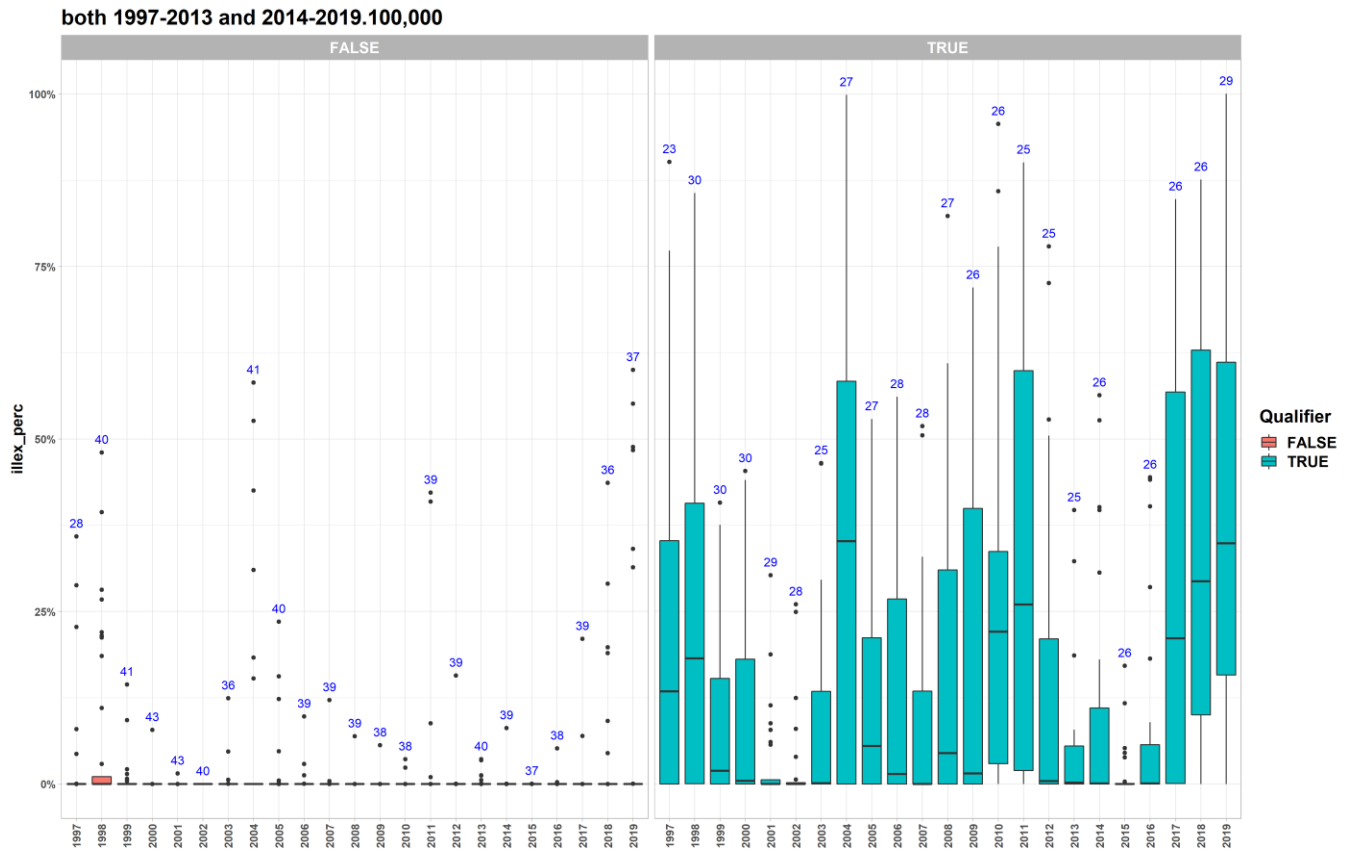
Bar is the interquartile (middle) range (IQR); black line is the median; vertical lines extend to observations near 1.5 * IQR; outliers are dots. “False” = Non-Requalifiers (on left); “True” = Requalifiers (on right)

Figure A16. 1997-2013 plus 2014-2019/50K Option Dependencies



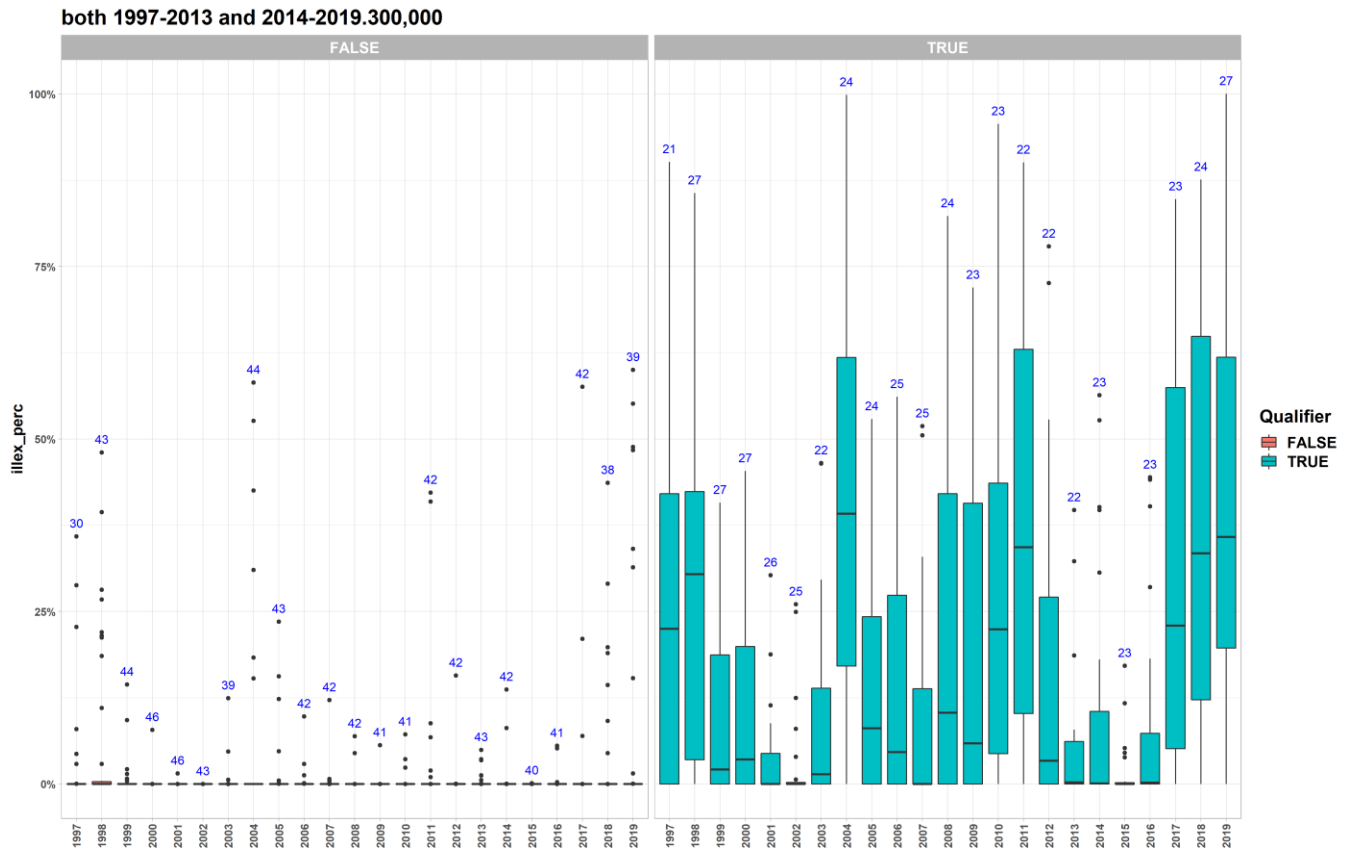
Bar is the interquartile (middle) range (IQR); black line is the median; vertical lines extend to observations near 1.5 * IQR; outliers are dots. “False” = Non-Requalifiers (on left); “True” = Requalifiers (on right)

Figure A17. 1997-2013 plus 2014-2019/100K Option Dependencies



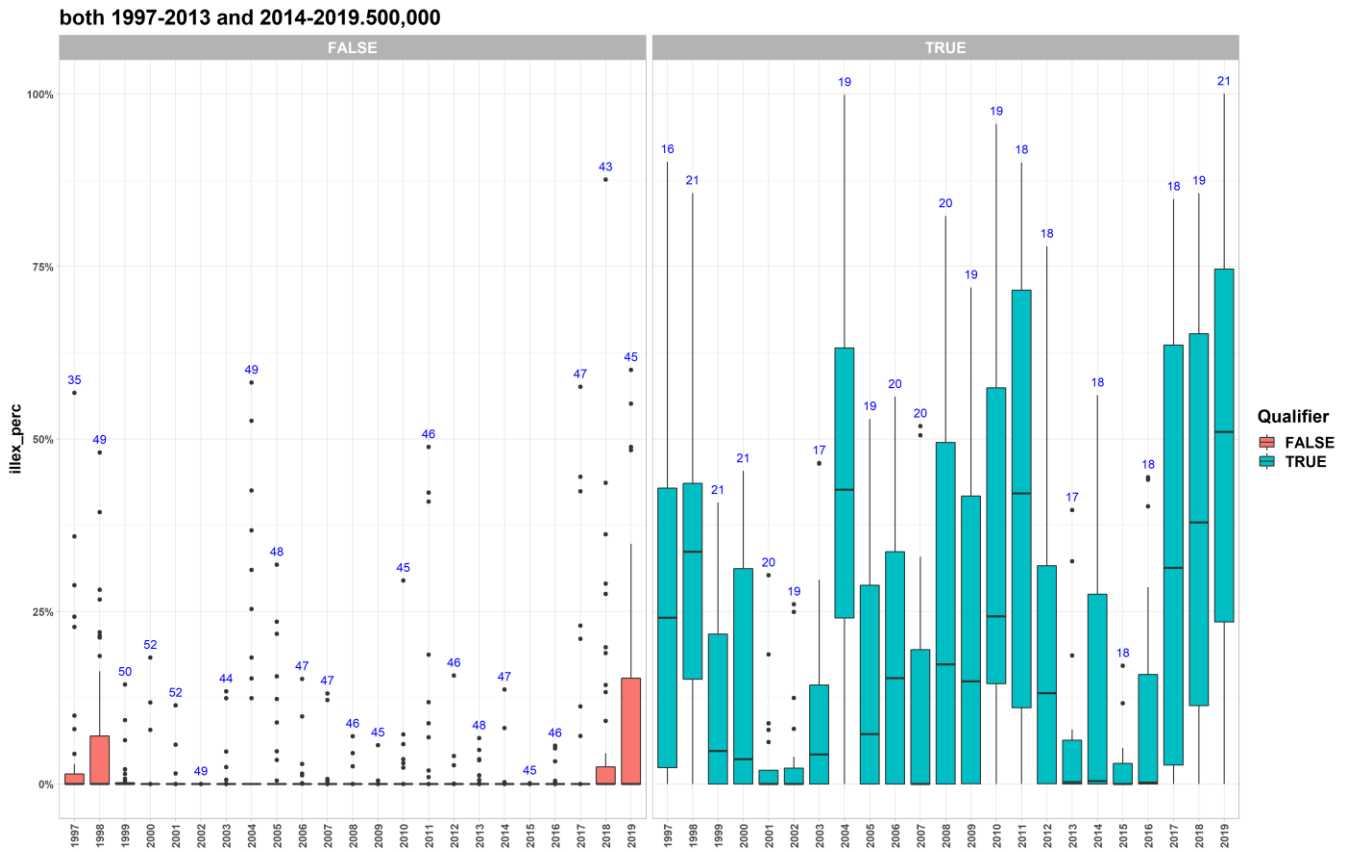
Bar is the interquartile (middle) range (IQR); black line is the median; vertical lines extend to observations near 1.5 * IQR; outliers are dots. “False” = Non-Requalifiers (on left); “True” = Requalifiers (on right)

Figure A18. 1997-2013 plus 2014-2019/300K Option Dependencies



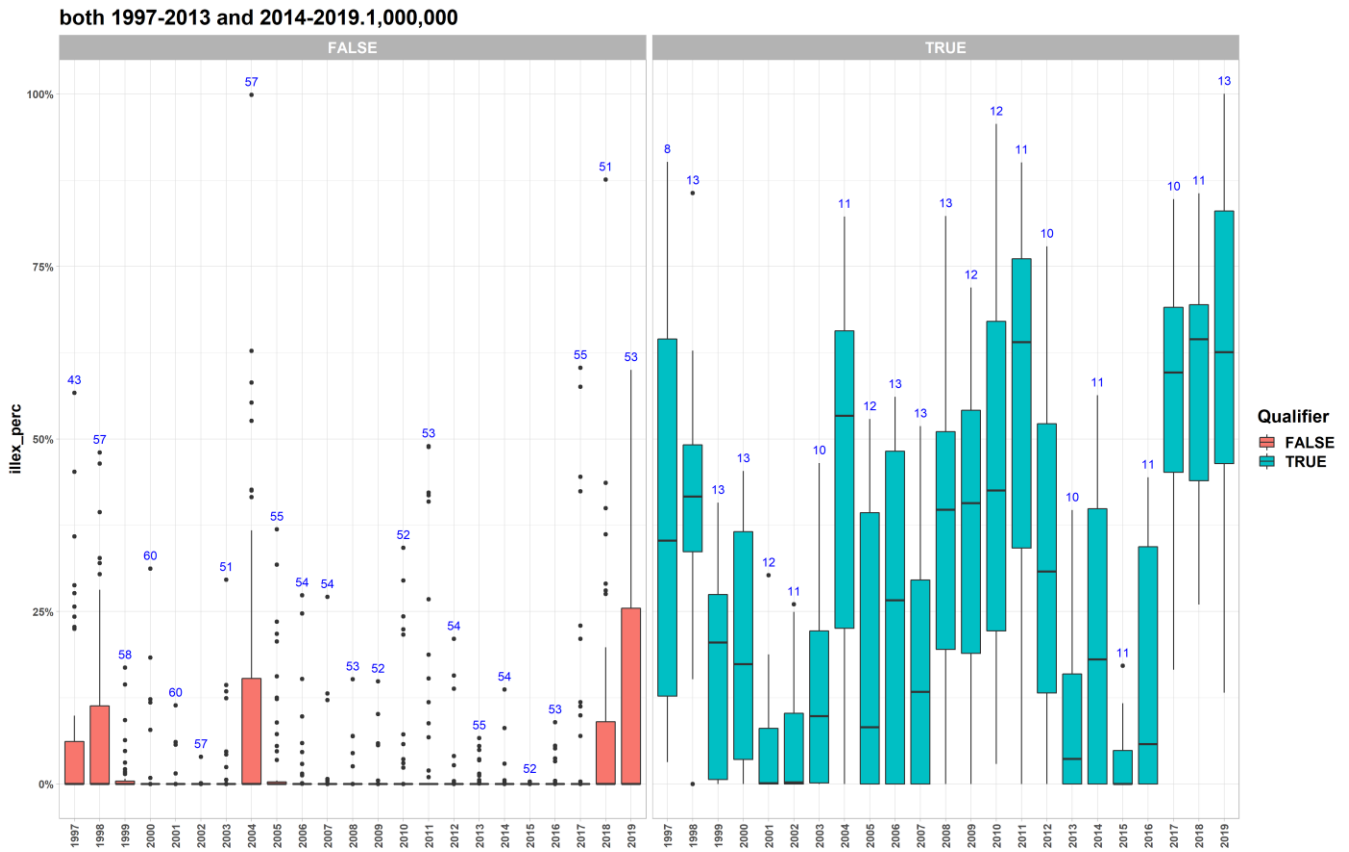
Bar is the interquartile (middle) range (IQR); black line is the median; vertical lines extend to observations near 1.5 * IQR; outliers are dots. “False” = Non-Requalifiers (on left); “True” = Requalifiers (on right)

Figure A19. 1997-2013 plus 2014-2019/500K Option Dependencies



Bar is the interquartile (middle) range (IQR); black line is the median; vertical lines extend to observations near 1.5 * IQR; outliers are dots. “False” = Non-Requalifiers (on left); “True” = Requalifiers (on right)

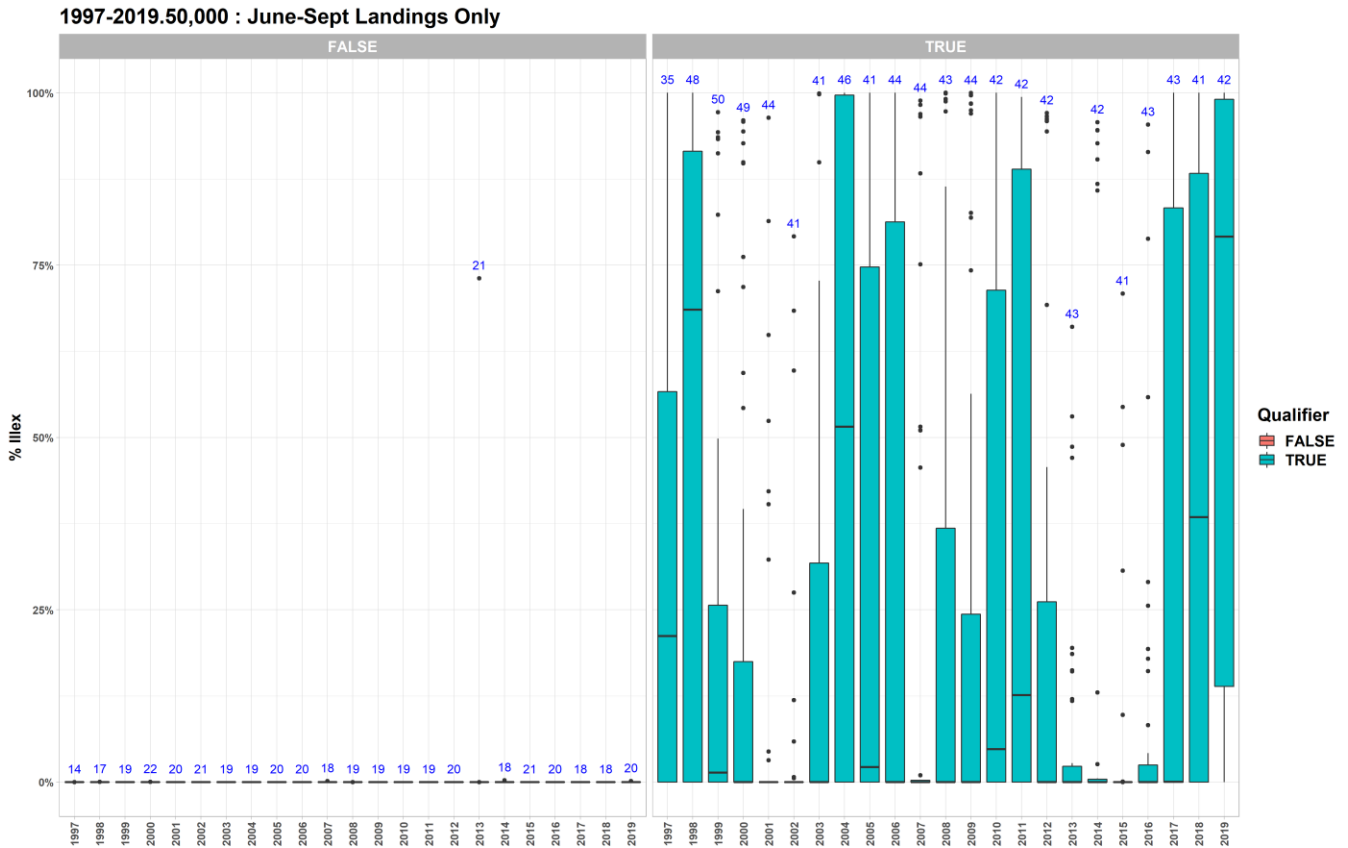
Figure A20. 1997-2013 plus 2014-2019/1,000,000 Option Dependencies



Bar is the interquartile (middle) range (IQR); black line is the median; vertical lines extend to observations near 1.5 * IQR; outliers are dots. “False” = Non-Requalifiers (on left); “True” = Requalifiers (on right)

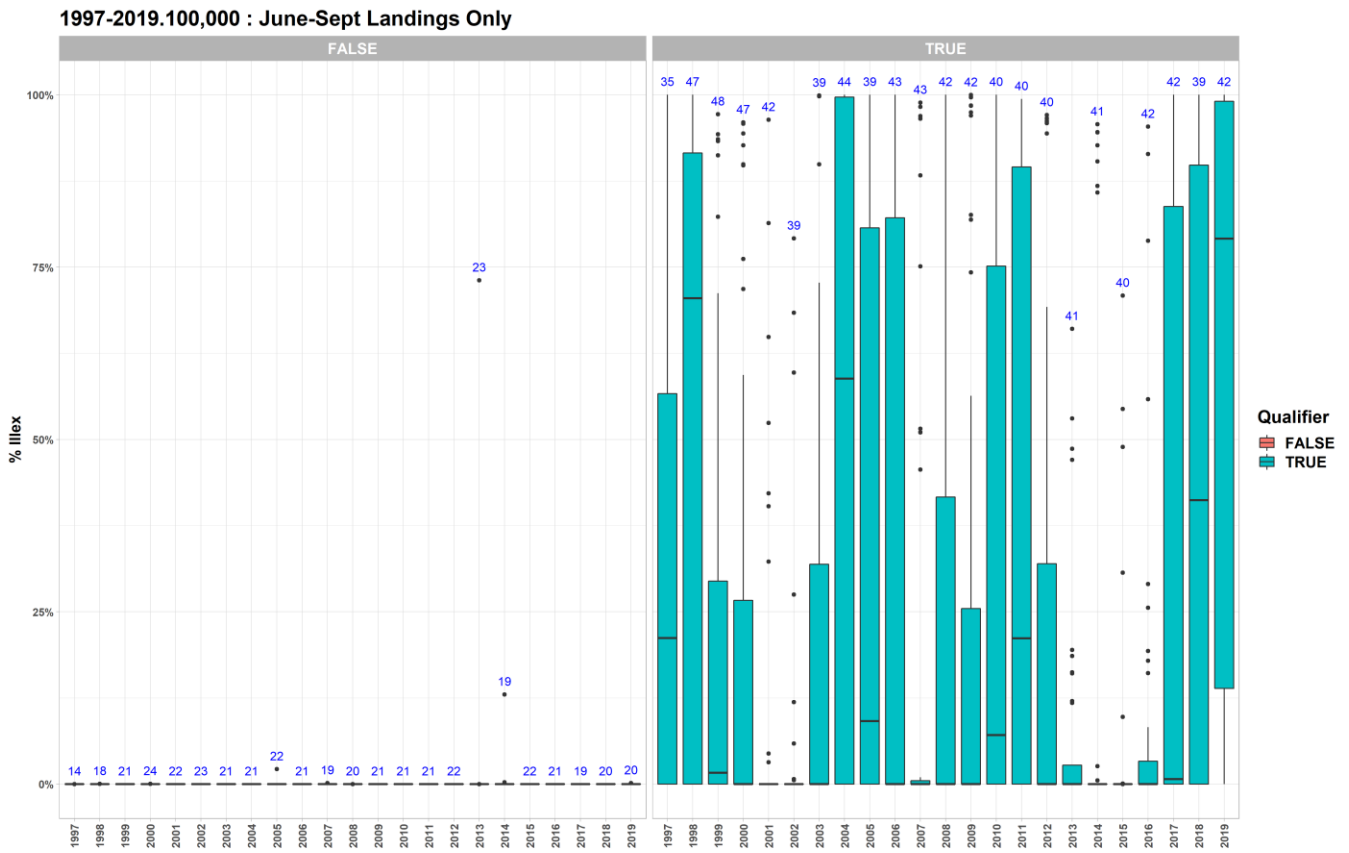
Appendix B. Boxplots of Seasonal (June 1-Sept 30) Dependence on *Illex* (Revenues) for Requalification Options

Figure B1. 1997-2019/50K Option Seasonal (June 1-Sept 30) Dependencies.



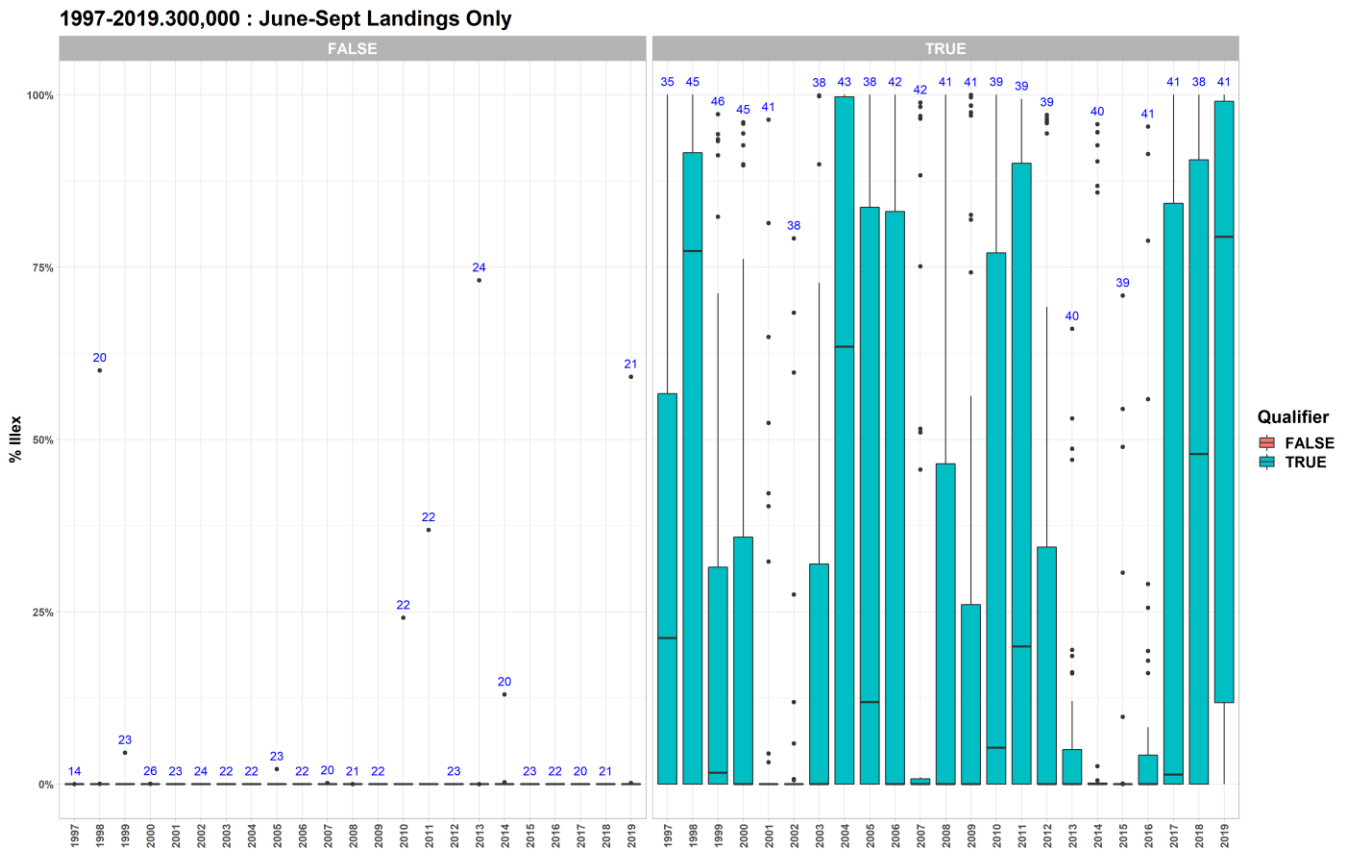
Bar is the interquartile (middle) range (IQR); black line is the median; vertical lines extend to observations near 1.5 * IQR; outliers are dots. “False” = Non-Requalifiers (on left); “True” = Requalifiers (on right)

Figure B2. 1997-2019/100K Option Seasonal (June 1-Sept 30) Dependencies.



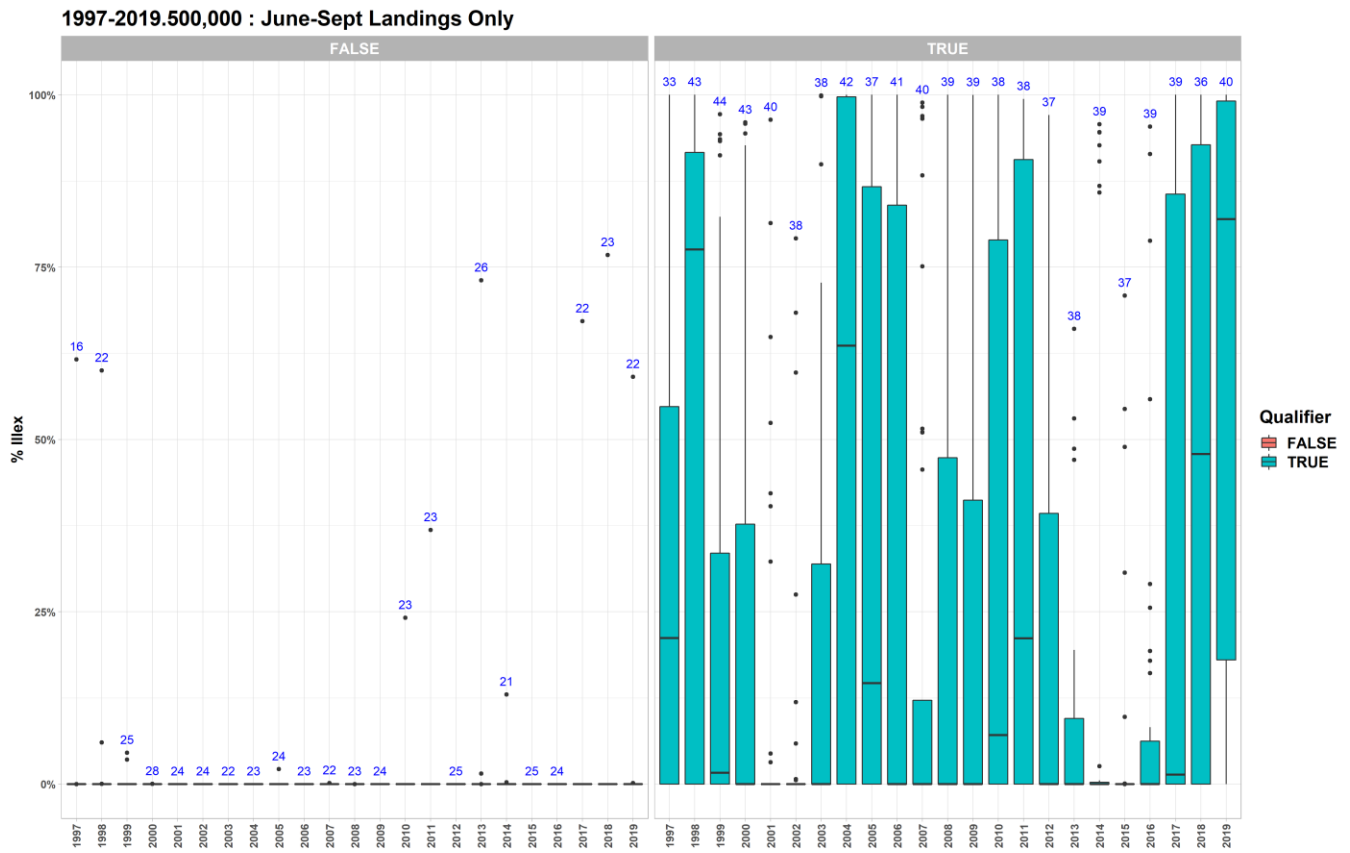
Bar is the interquartile (middle) range (IQR); black line is the median; vertical lines extend to observations near 1.5 * IQR; outliers are dots. “False” = Non-Requalifiers (on left); “True” = Requalifiers (on right)

Figure B3. 1997-2019/300K Option Seasonal (June 1-Sept 30) Dependencies.



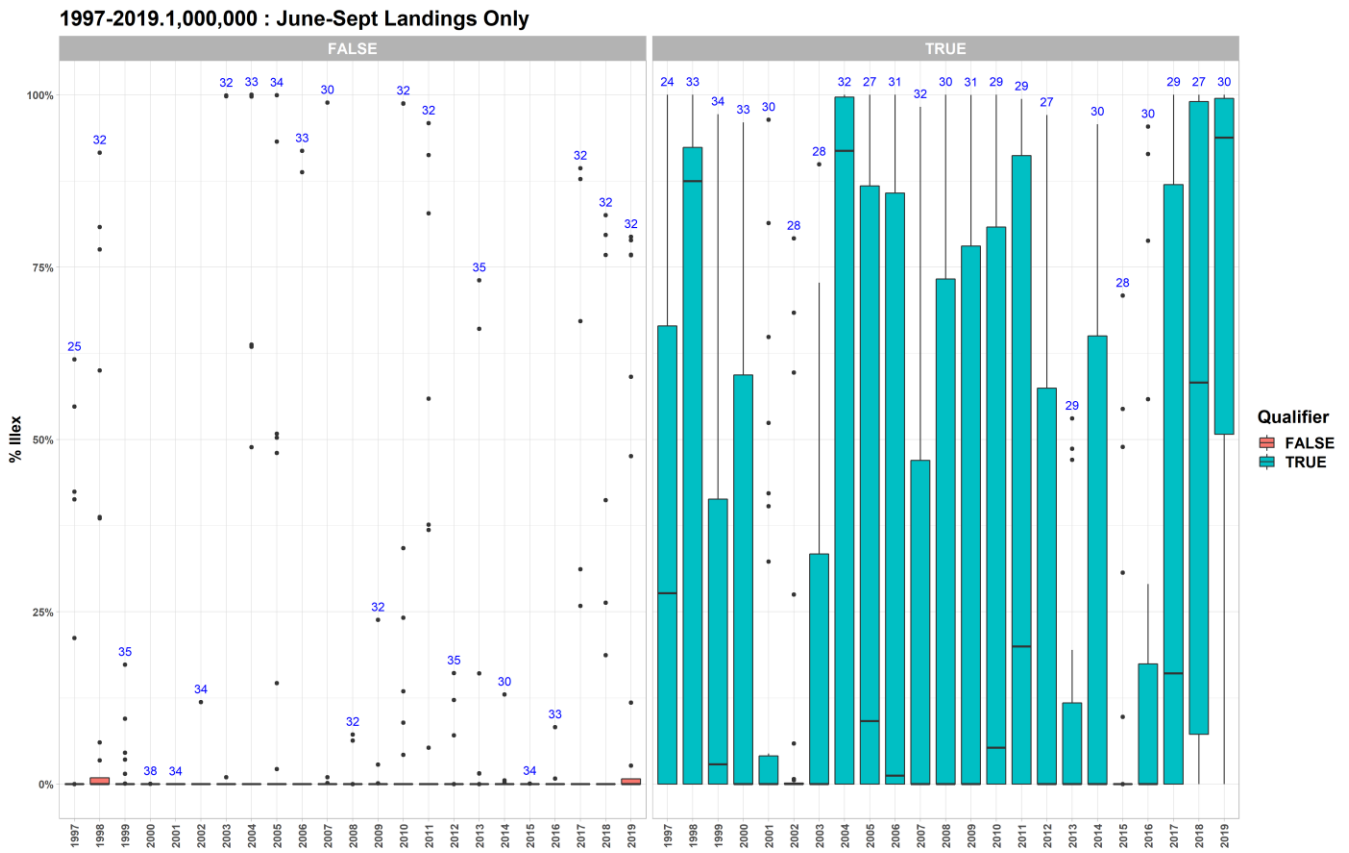
Bar is the interquartile (middle) range (IQR); black line is the median; vertical lines extend to observations near 1.5 * IQR; outliers are dots. “False” = Non-Requalifiers (on left); “True” = Requalifiers (on right)

Figure B4. 1997-2019/500K Option Seasonal (June 1-Sept 30) Dependencies.



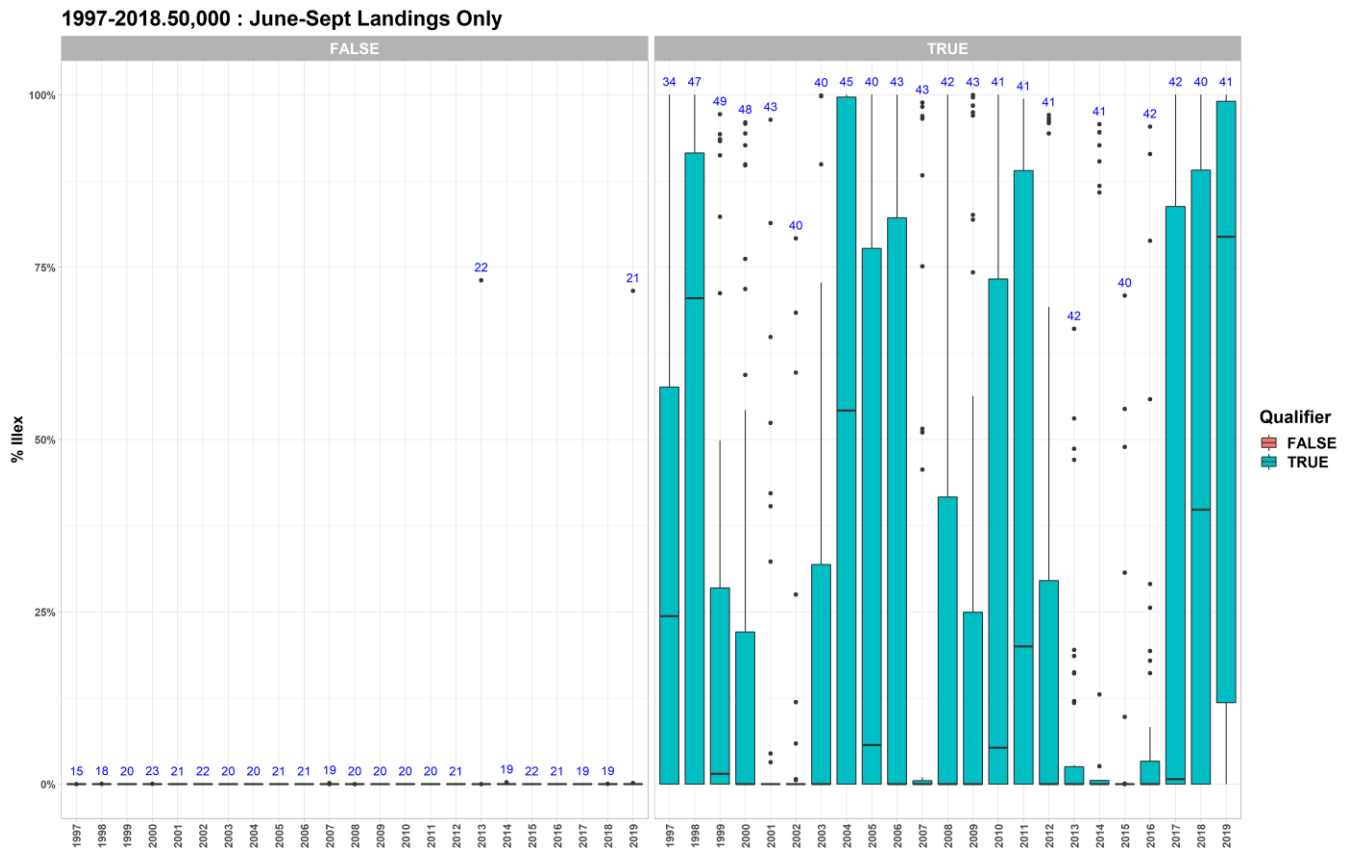
Bar is the interquartile (middle) range (IQR); black line is the median; vertical lines extend to observations near 1.5 * IQR; outliers are dots. “False” = Non-Requalifiers (on left); “True” = Requalifiers (on right)

Figure B5. 1997-2019/1,000,000 Option Seasonal (June 1-Sept 30) Dependencies.



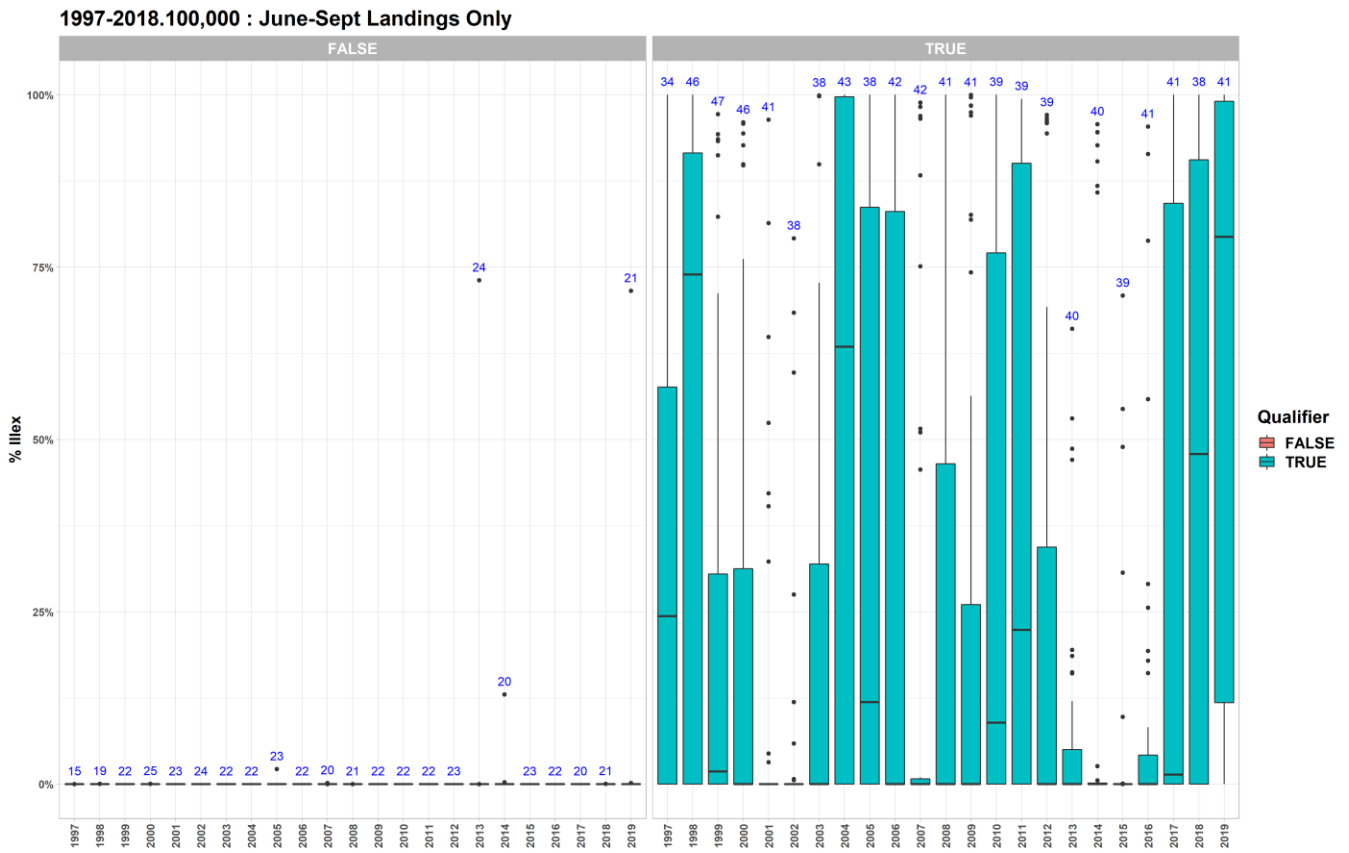
Bar is the interquartile (middle) range (IQR); black line is the median; vertical lines extend to observations near 1.5 * IQR; outliers are dots. “False” = Non-Requalifiers (on left); “True” = Requalifiers (on right)

Figure B6. 1997-2018/50K Option Seasonal (June 1-Sept 30) Dependencies.



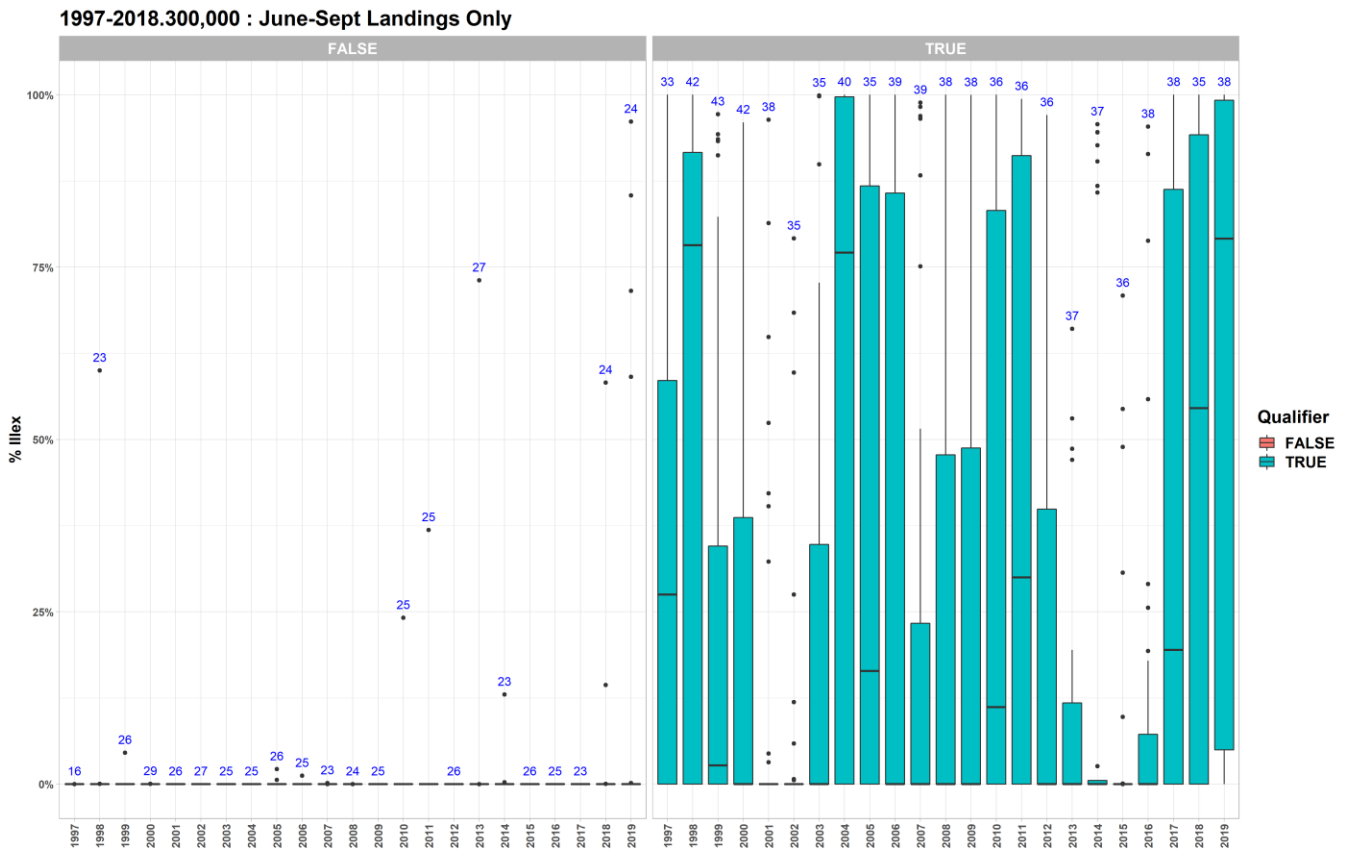
Bar is the interquartile (middle) range (IQR); black line is the median; vertical lines extend to observations near 1.5 * IQR; outliers are dots. “False” = Non-Requalifiers (on left); “True” = Requalifiers (on right)

Figure B7. 1997-2018/100K Option Seasonal (June 1-Sept 30) Dependencies.



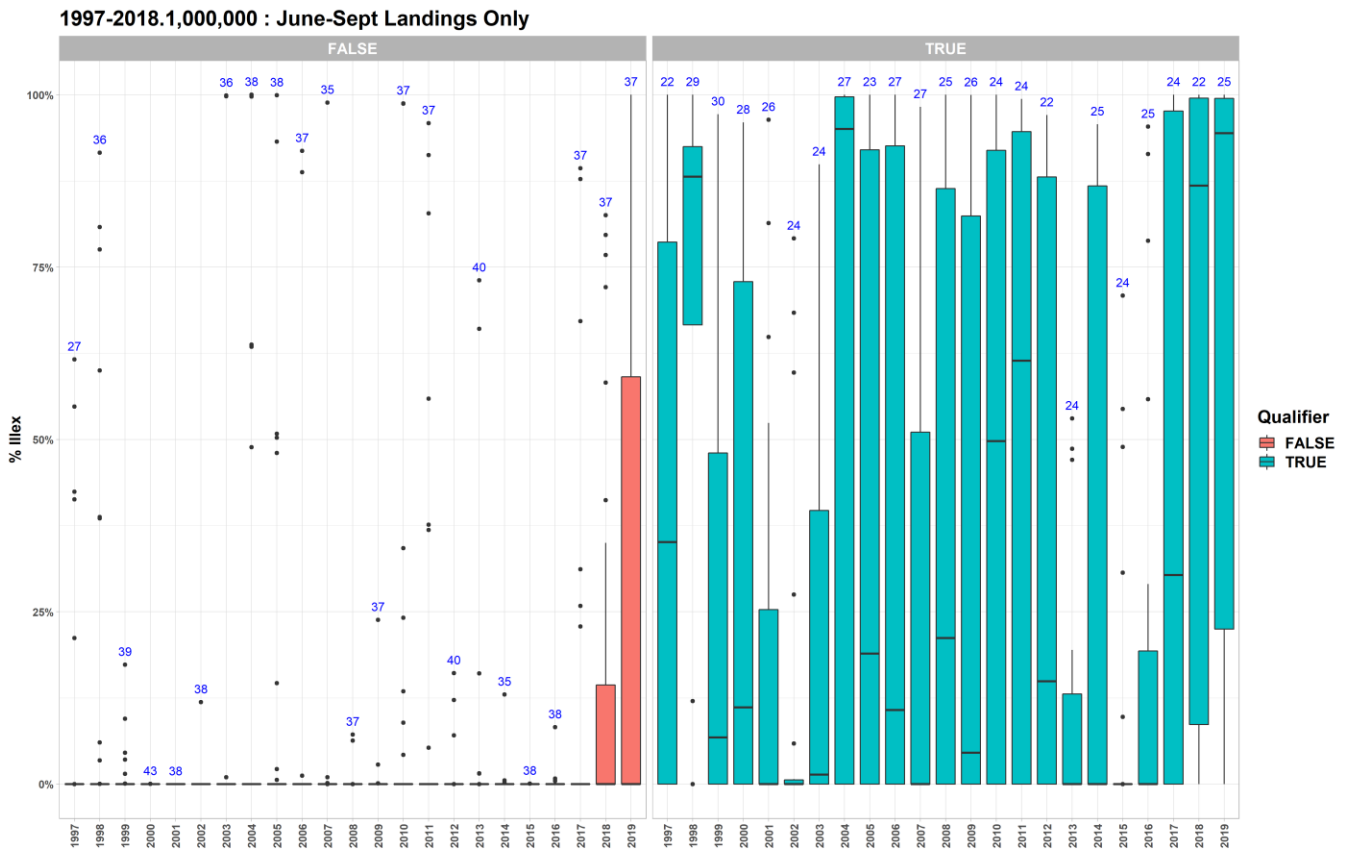
Bar is the interquartile (middle) range (IQR); black line is the median; vertical lines extend to observations near 1.5 * IQR; outliers are dots. “False” = Non-Requalifiers (on left); “True” = Requalifiers (on right)

Figure B8. 1997-2018/300K Trip Option Seasonal (June 1-Sept 30) Dependencies.



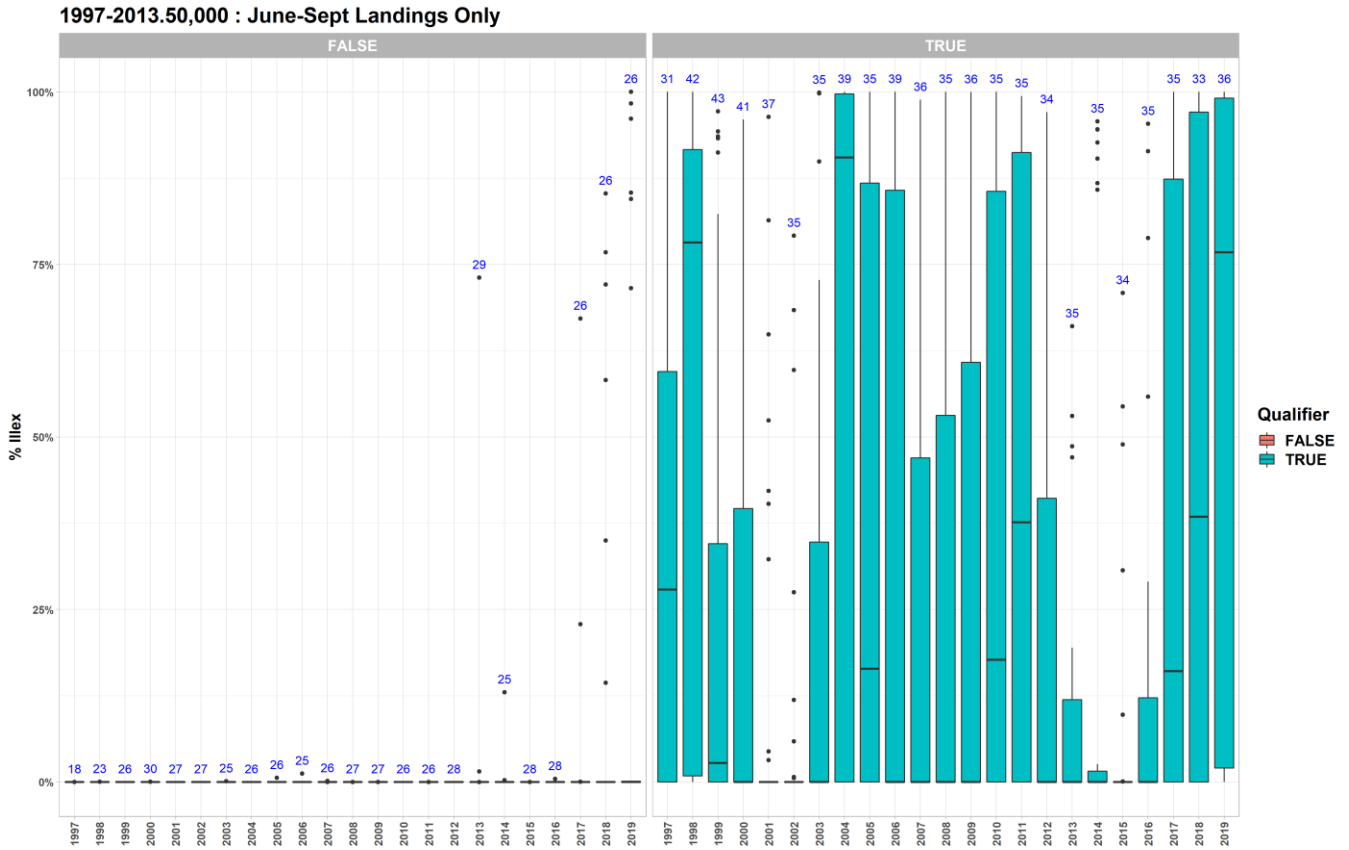
Bar is the interquartile (middle) range (IQR); black line is the median; vertical lines extend to observations near 1.5 * IQR; outliers are dots. “False” = Non-Requalifiers (on left); “True” = Requalifiers (on right)

Figure B10. 1997-2018/1,000,000 Option Seasonal (June 1-Sept 30) Dependencies.



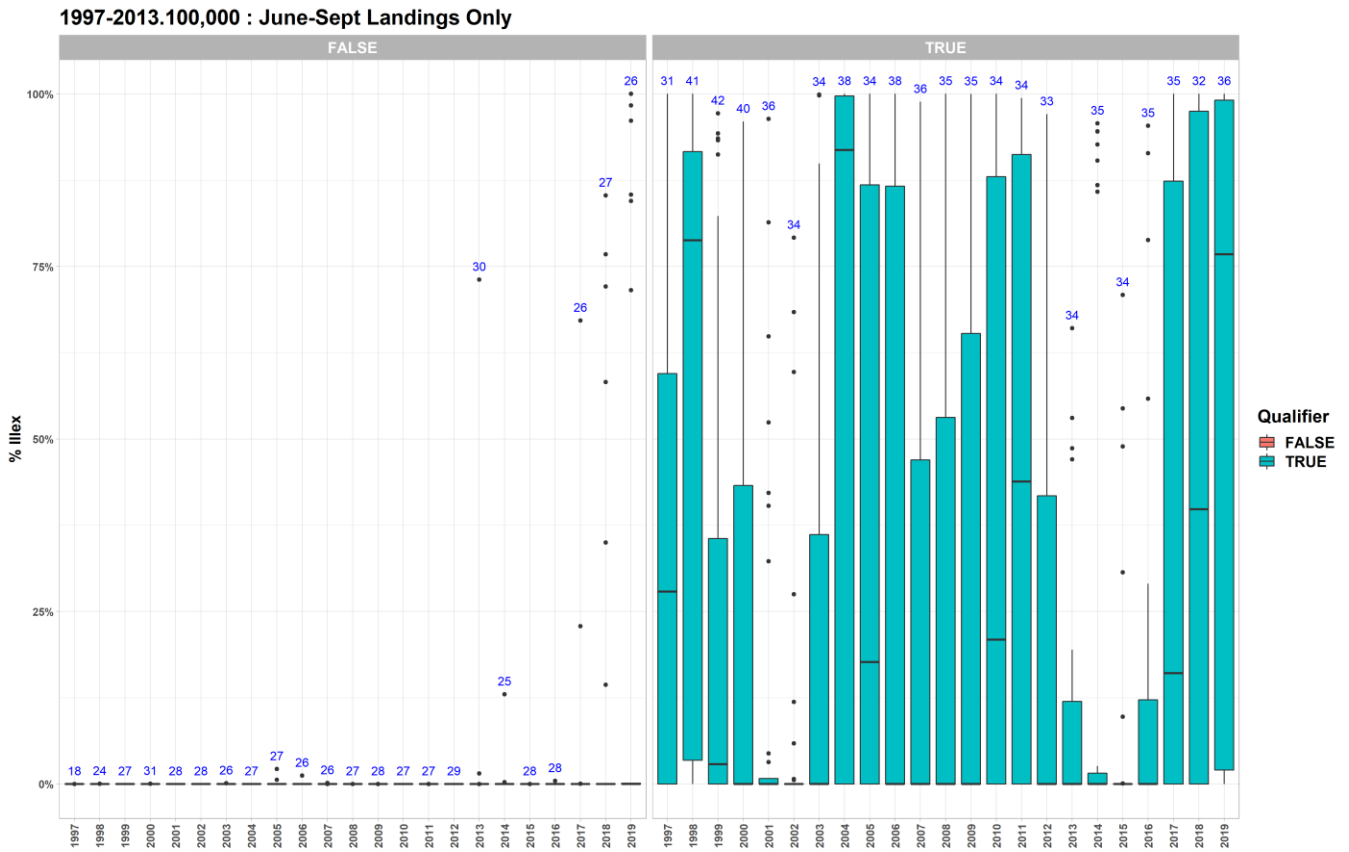
Bar is the interquartile (middle) range (IQR); black line is the median; vertical lines extend to observations near 1.5 * IQR; outliers are dots. “False” = Non-Requalifiers (on left); “True” = Requalifiers (on right)

Figure B11. 1997-2013/50K Option Seasonal (June 1-Sept 30) Dependencies.



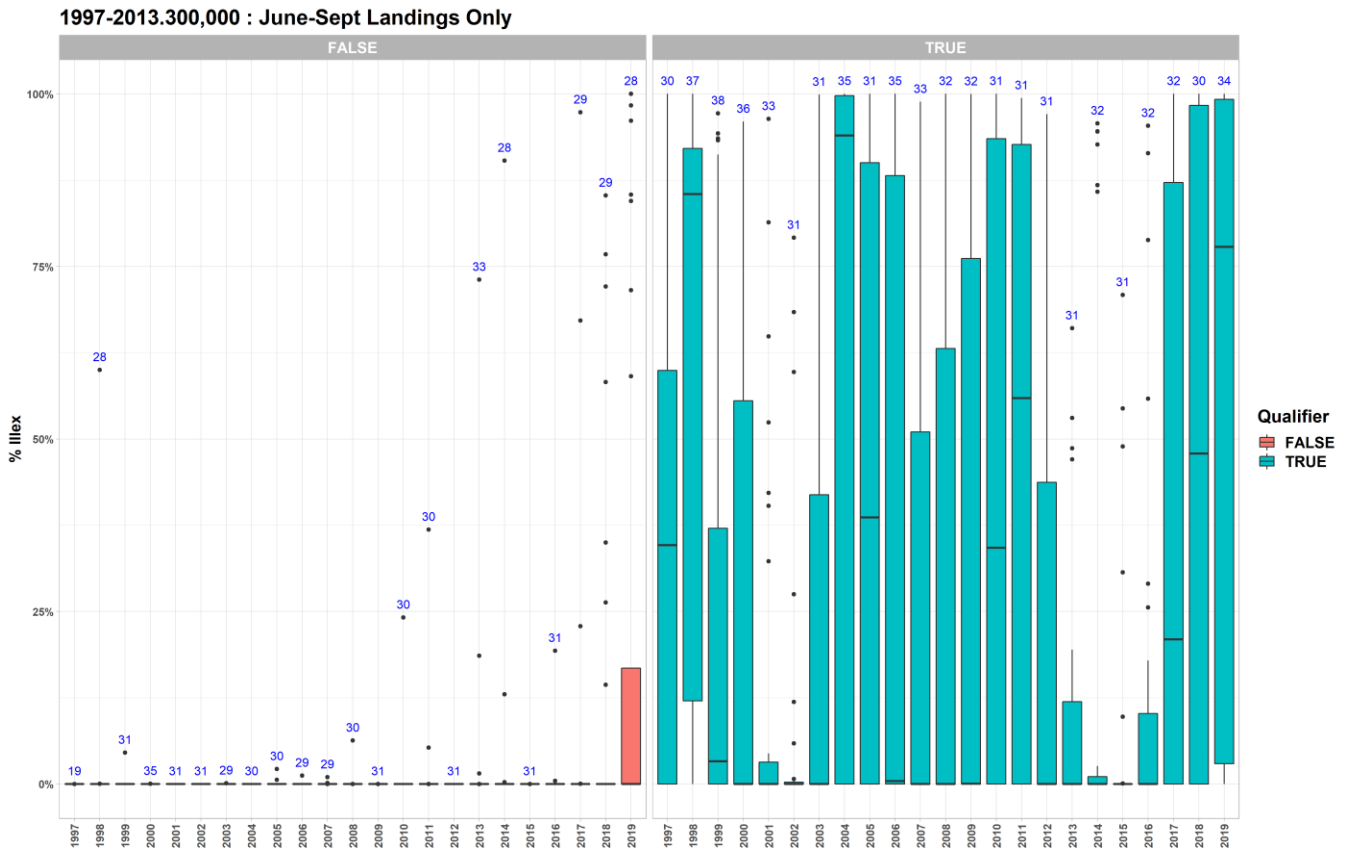
Bar is the interquartile (middle) range (IQR); black line is the median; vertical lines extend to observations near 1.5 * IQR; outliers are dots. “False” = Non-Requalifiers (on left); “True” = Requalifiers (on right)

Figure B12. 1997-2013/100K Option Seasonal (June 1-Sept 30) Dependencies.



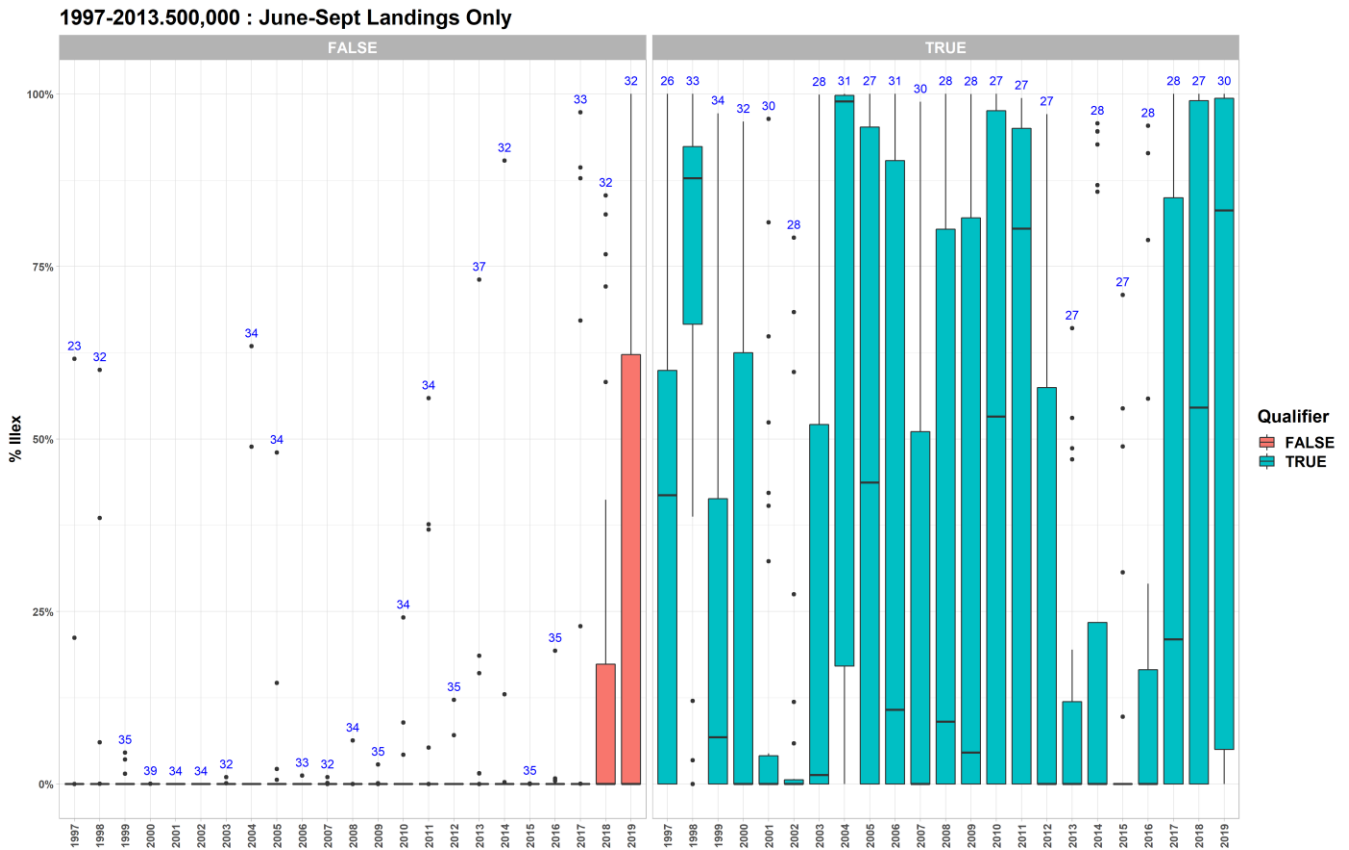
Bar is the interquartile (middle) range (IQR); black line is the median; vertical lines extend to observations near 1.5 * IQR; outliers are dots. “False” = Non-Requalifiers (on left); “True” = Requalifiers (on right)

Figure B13. 1997-2013/300K Option Seasonal (June 1-Sept 30) Dependencies.



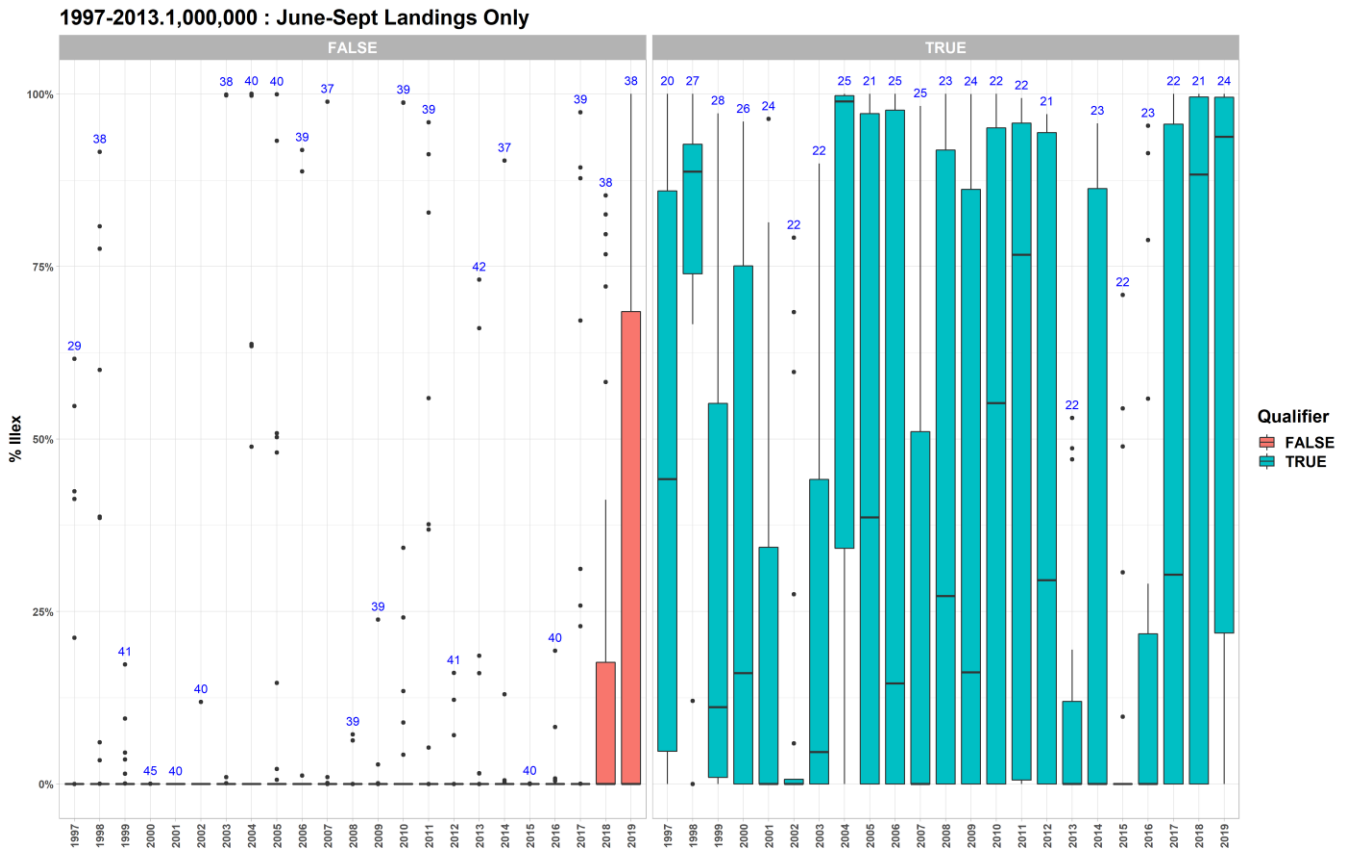
Bar is the interquartile (middle) range (IQR); black line is the median; vertical lines extend to observations near 1.5 * IQR; outliers are dots. “False” = Non-Requalifiers (on left); “True” = Requalifiers (on right)

Figure B14. 1997-2013/500K Option Seasonal (June 1-Sept 30) Dependencies.



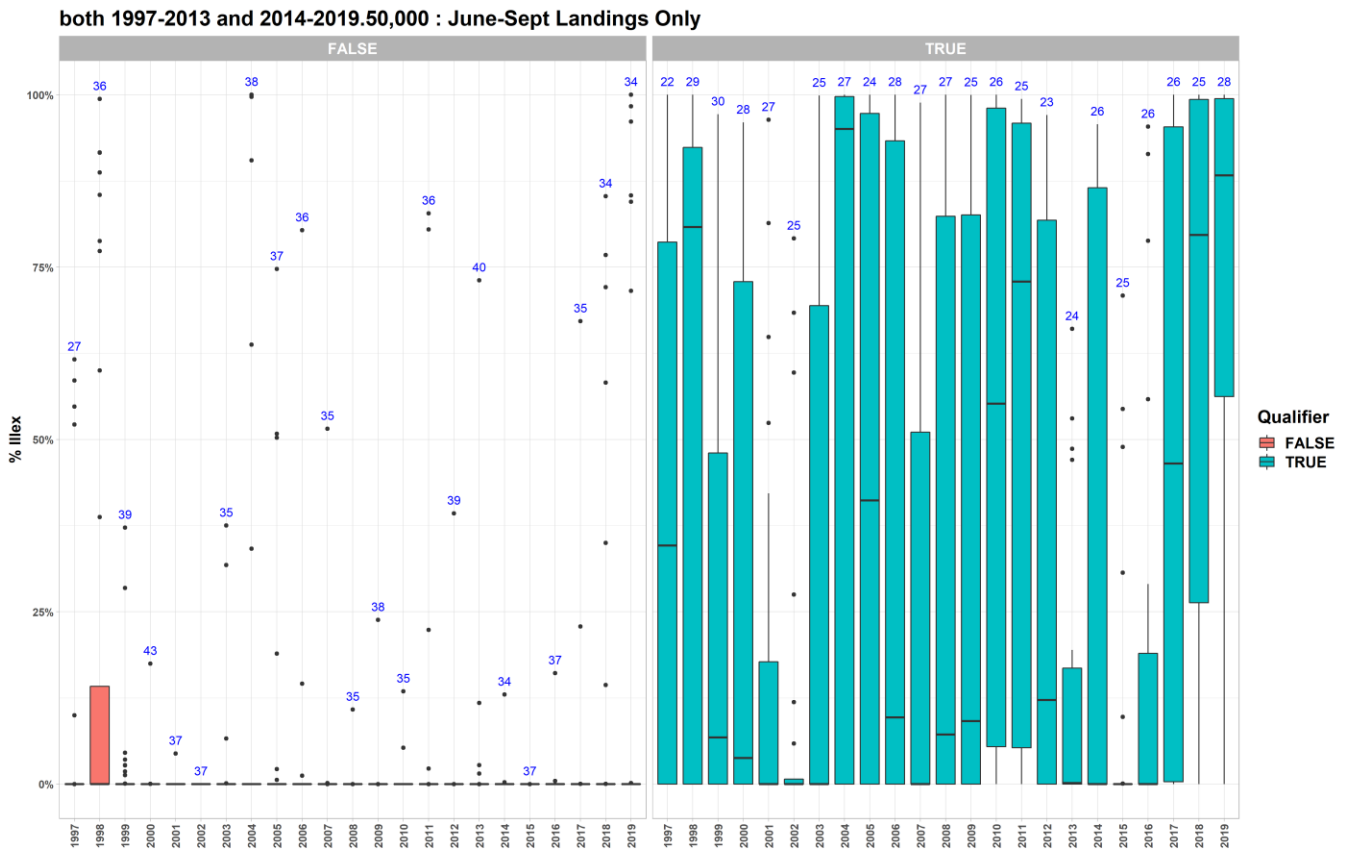
Bar is the interquartile (middle) range (IQR); black line is the median; vertical lines extend to observations near 1.5 * IQR; outliers are dots. “False” = Non-Requalifiers (on left); “True” = Requalifiers (on right)

Figure B15. 1997-2013/1,000,000 Option Seasonal (June 1-Sept 30) Dependencies.



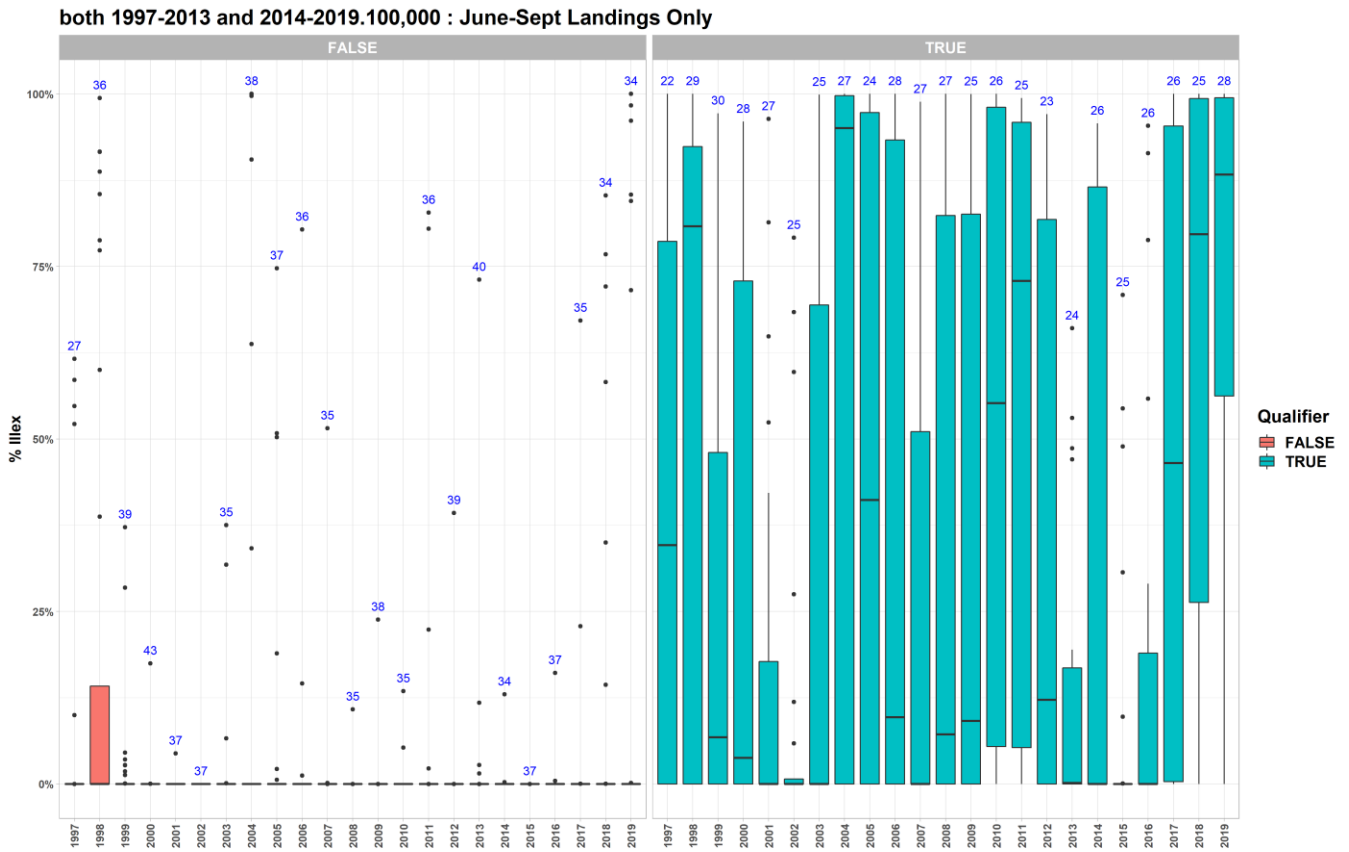
Bar is the interquartile (middle) range (IQR); black line is the median; vertical lines extend to observations near 1.5 * IQR; outliers are dots. “False” = Non-Requalifiers (on left); “True” = Requalifiers (on right)

Figure B16. 1997-2013 plus 2014-2019/50K Option Seasonal (June 1-Sept 30) Dependencies



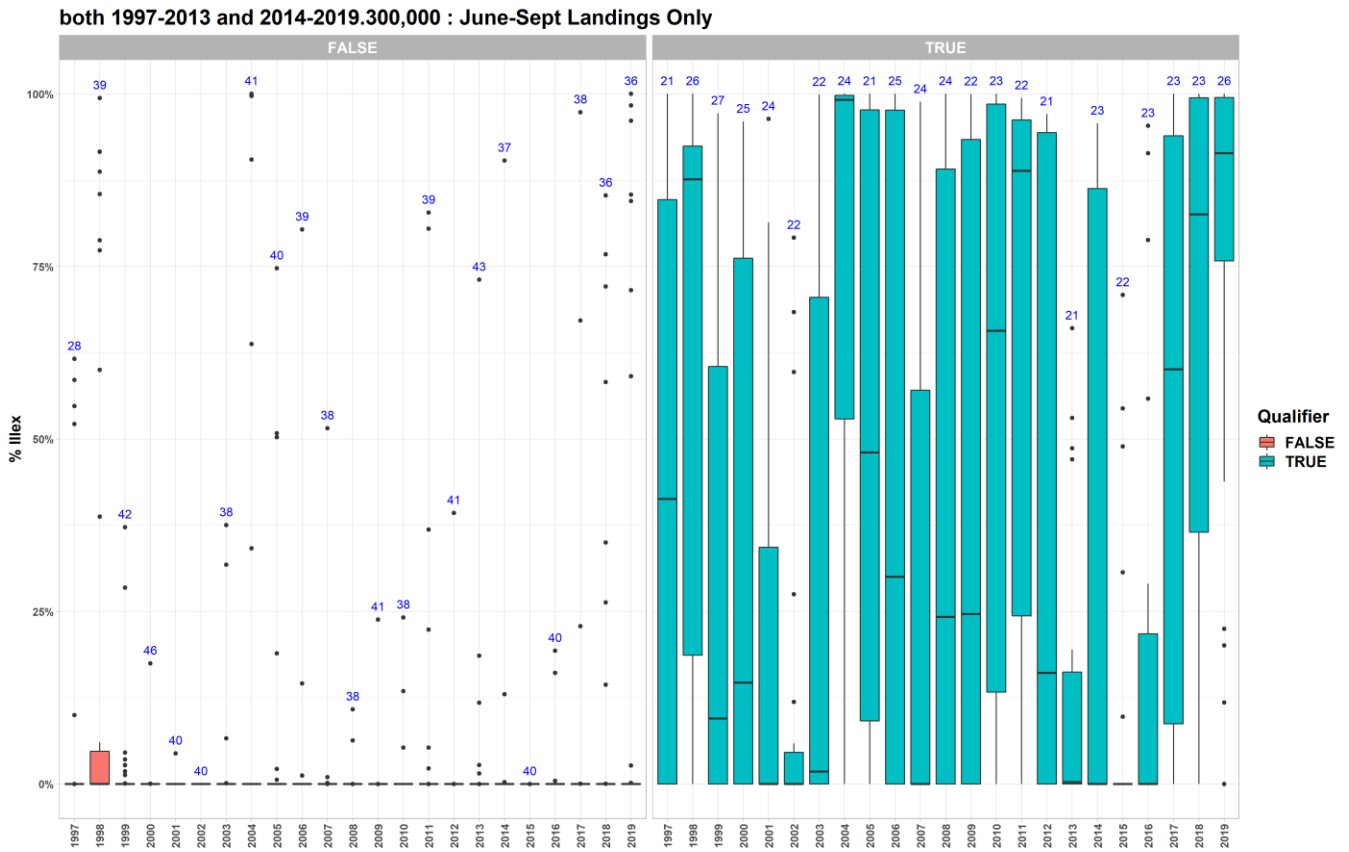
Bar is the interquartile (middle) range (IQR); black line is the median; vertical lines extend to observations near 1.5 * IQR; outliers are dots. “False” = Non-Requlifiers (on left); “True” = Requlifiers (on right)

Figure B17. 1997-2013 plus 2014-2019/100K Option Seasonal (June 1-Sept 30) Dependencies



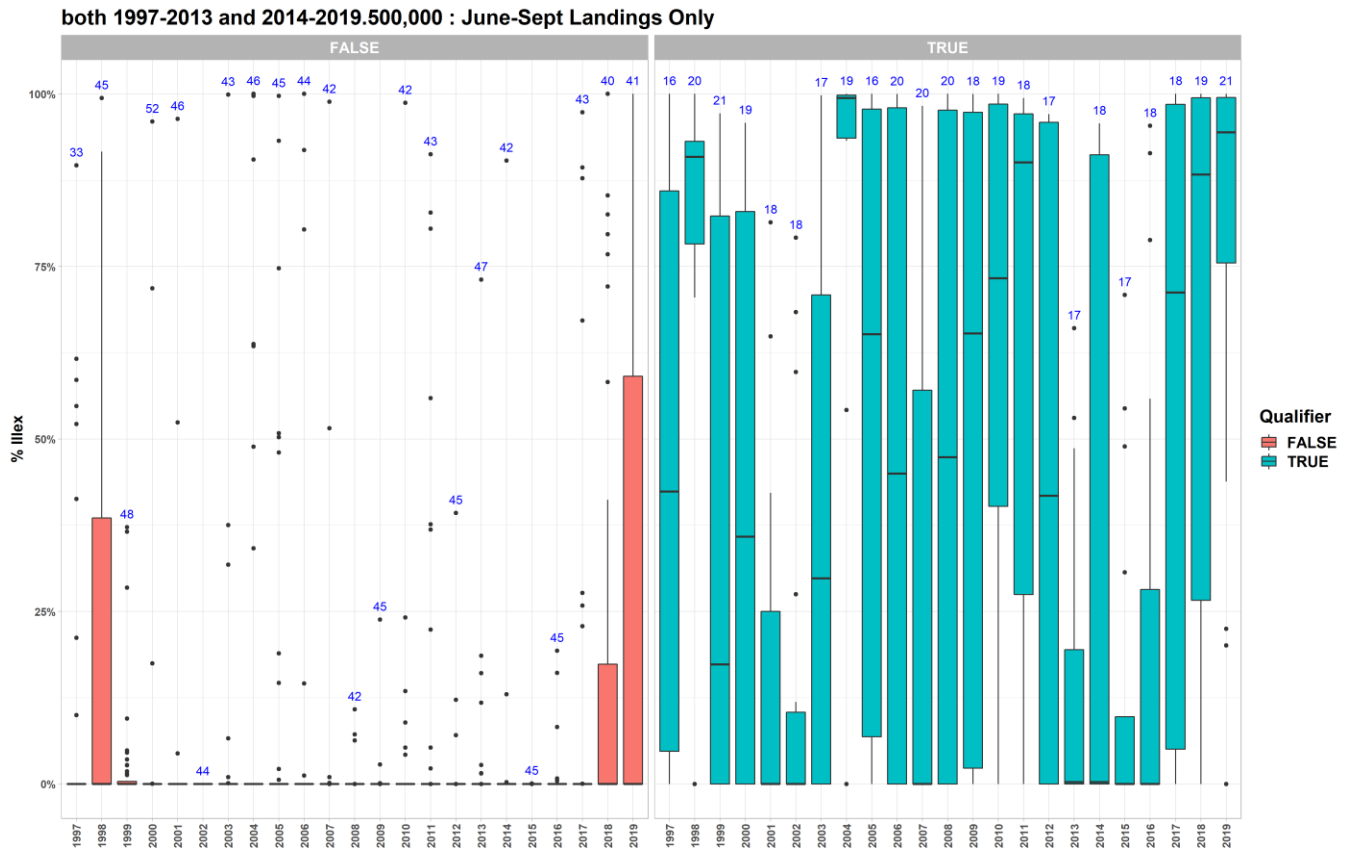
Bar is the interquartile (middle) range (IQR); black line is the median; vertical lines extend to observations near 1.5 * IQR; outliers are dots. “False” = Non-Requalifiers (on left); “True” = Requalifiers (on right)

Figure B18. 1997-2013 plus 2014-2019/300K Option Seasonal (June 1-Sept 30) Dependencies



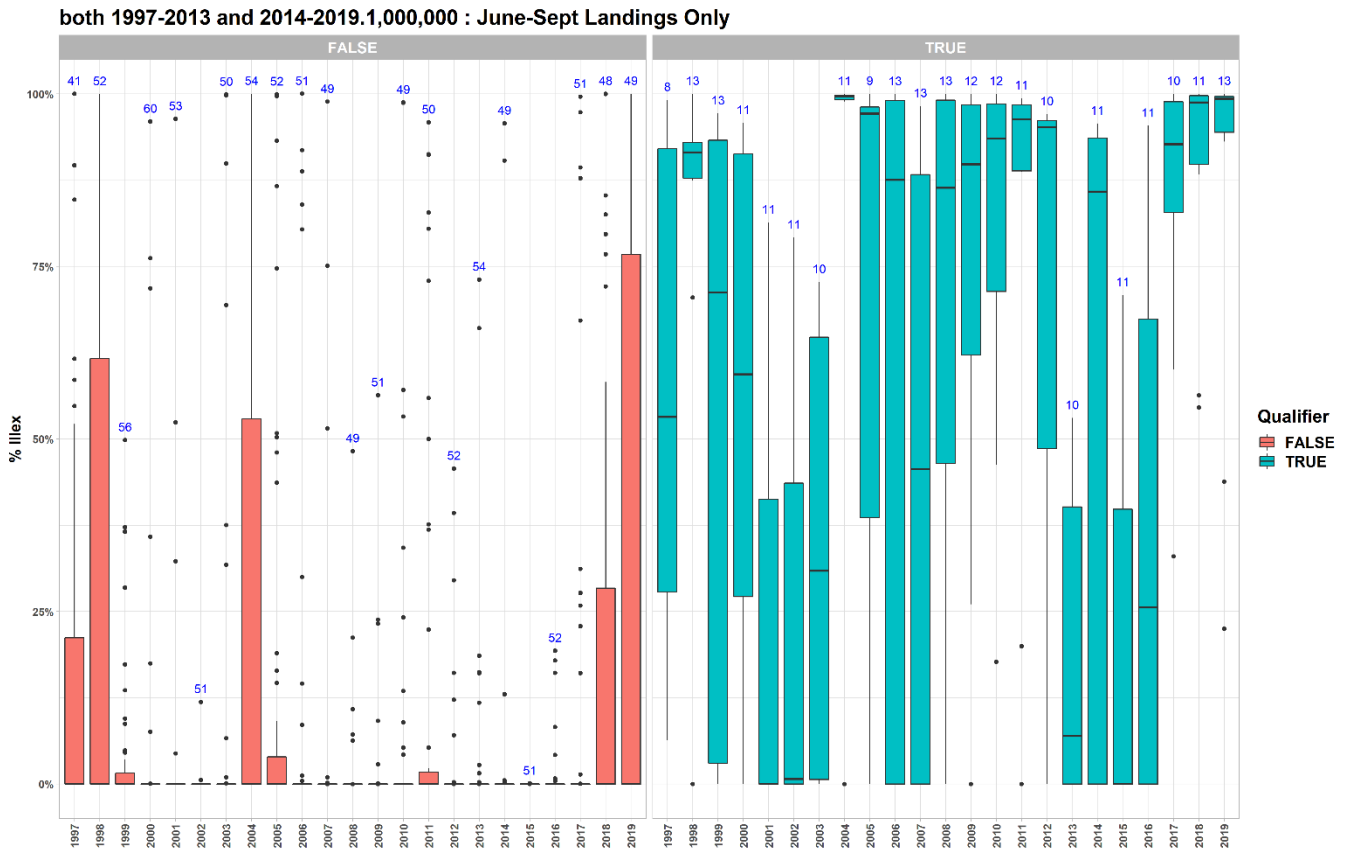
Bar is the interquartile (middle) range (IQR); black line is the median; vertical lines extend to observations near 1.5 * IQR; outliers are dots. “False” = Non-Requalifiers (on left); “True” = Requalifiers (on right)

Figure B19. 1997-2013 plus 2014-2019/500K Option Seasonal (June 1-Sept 30) Dependencies



Bar is the interquartile (middle) range (IQR); black line is the median; vertical lines extend to observations near 1.5 * IQR; outliers are dots. “False” = Non-Requalifiers (on left); “True” = Requalifiers (on right)

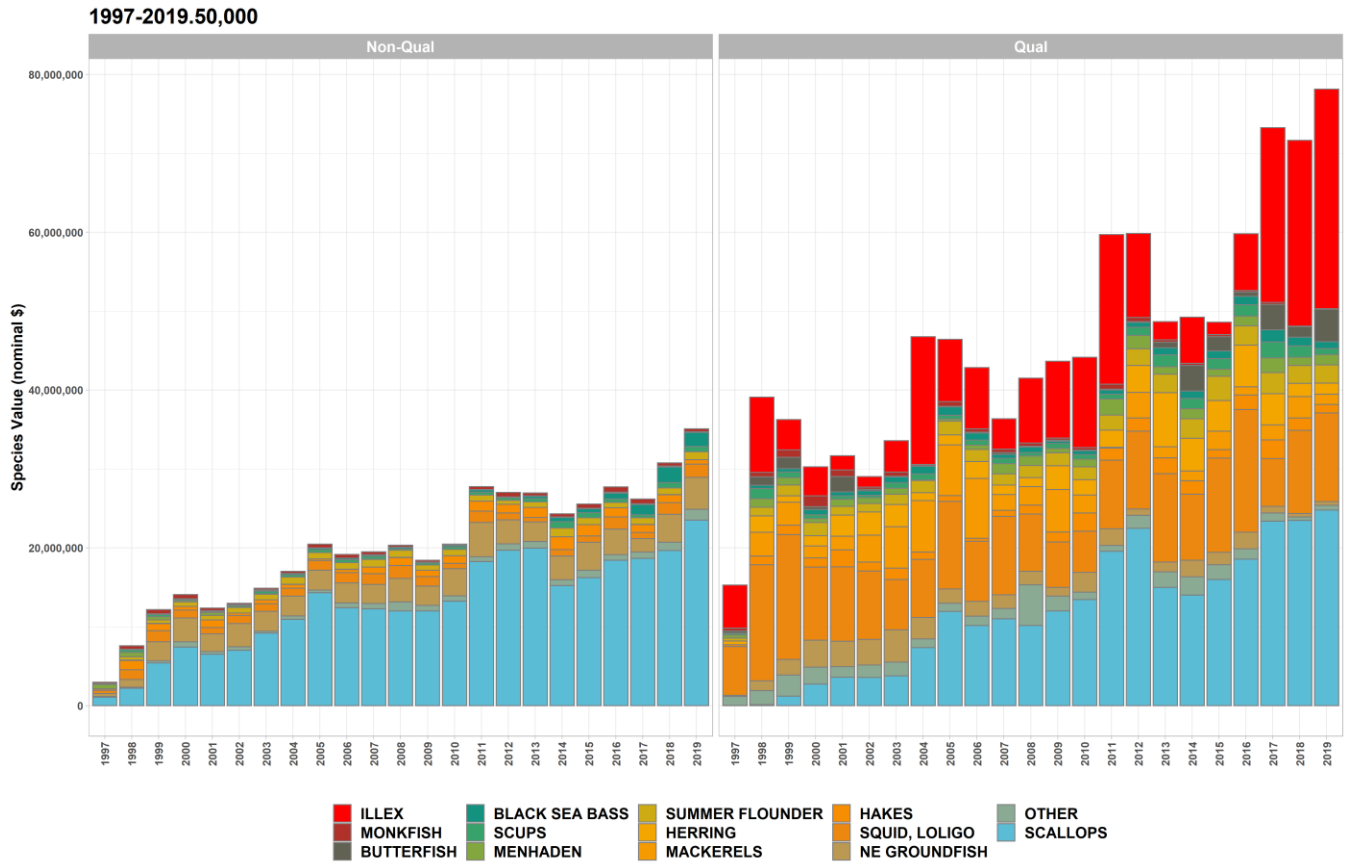
Figure B20. 1997-2013 plus 2014-2019/1,000,000 Option Seasonal (June 1-Sept 30) Dependencies



Bar is the interquartile (middle) range (IQR); black line is the median; vertical lines extend to observations near 1.5 * IQR; outliers are dots. “False” = Non-Requalifiers (on left); “True” = Requalifiers (on right)

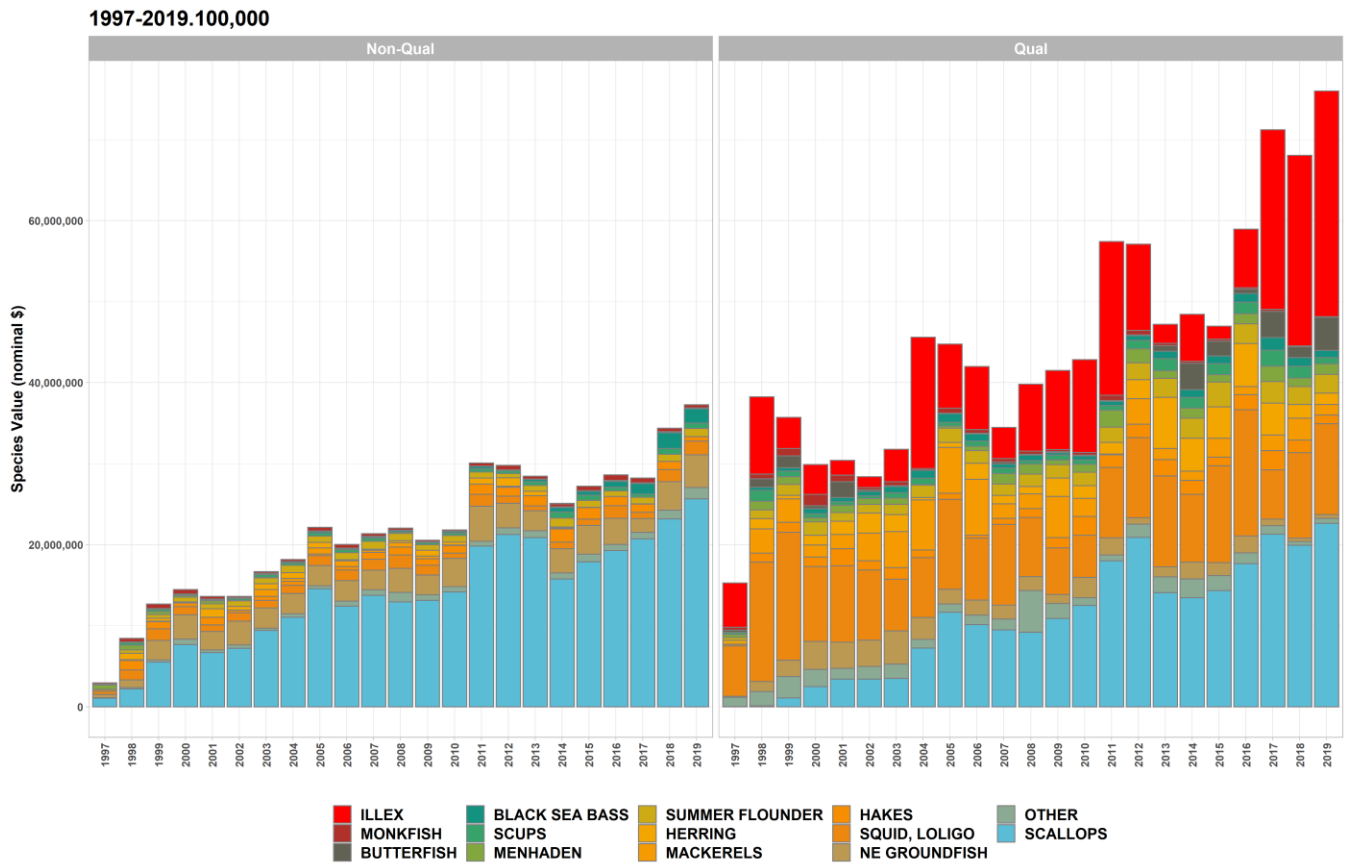
Appendix C. Barcharts of Revenue Sources for Non-Requalifiers and Requalifiers

Figure C1. 1997-2019/50K Option Revenues.



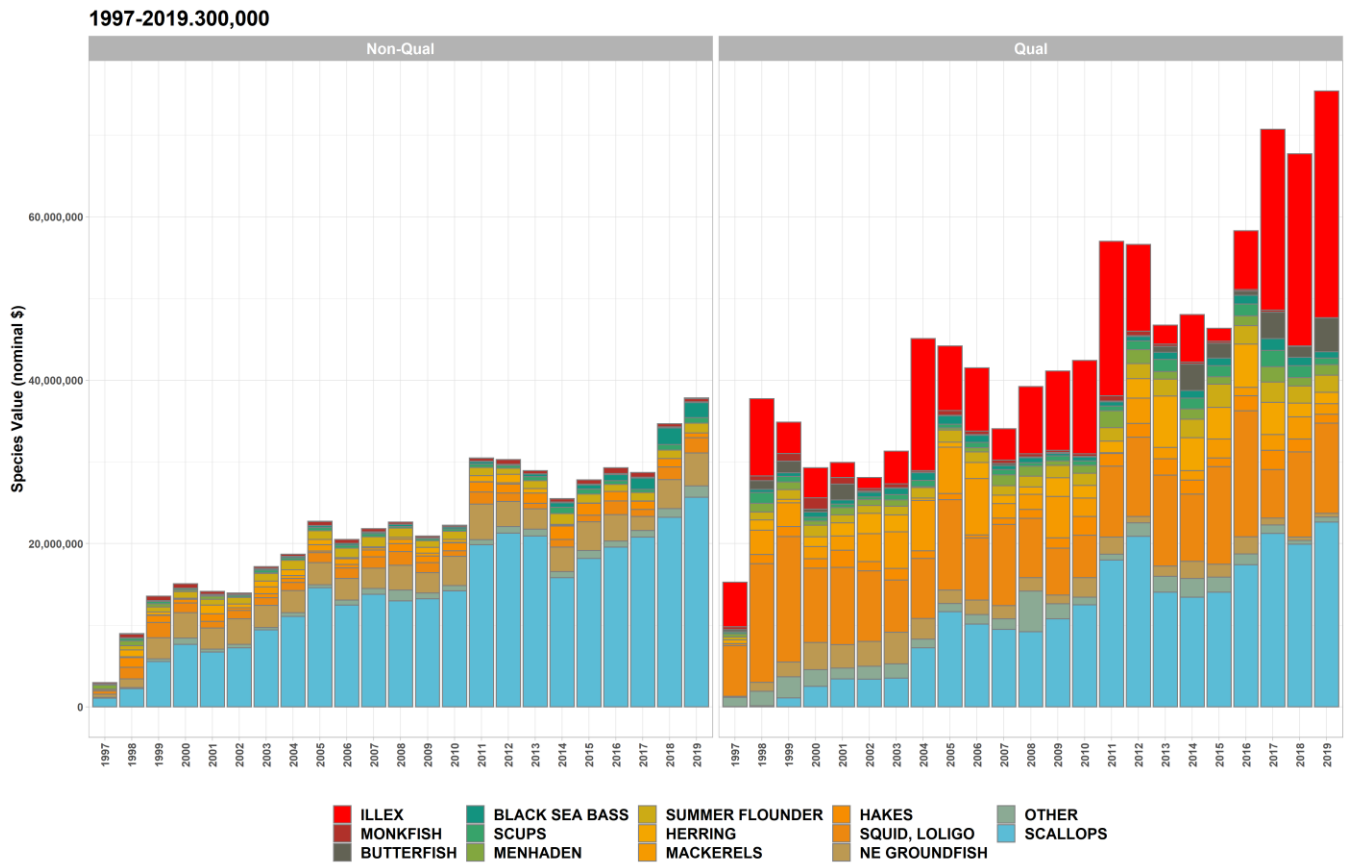
Total species revenues, by year. Species in the top 10 for any year are included. Non-requalifiers are on the left, requalifiers are on the right.

Figure C2. 1997-2019/100K Option Revenues.



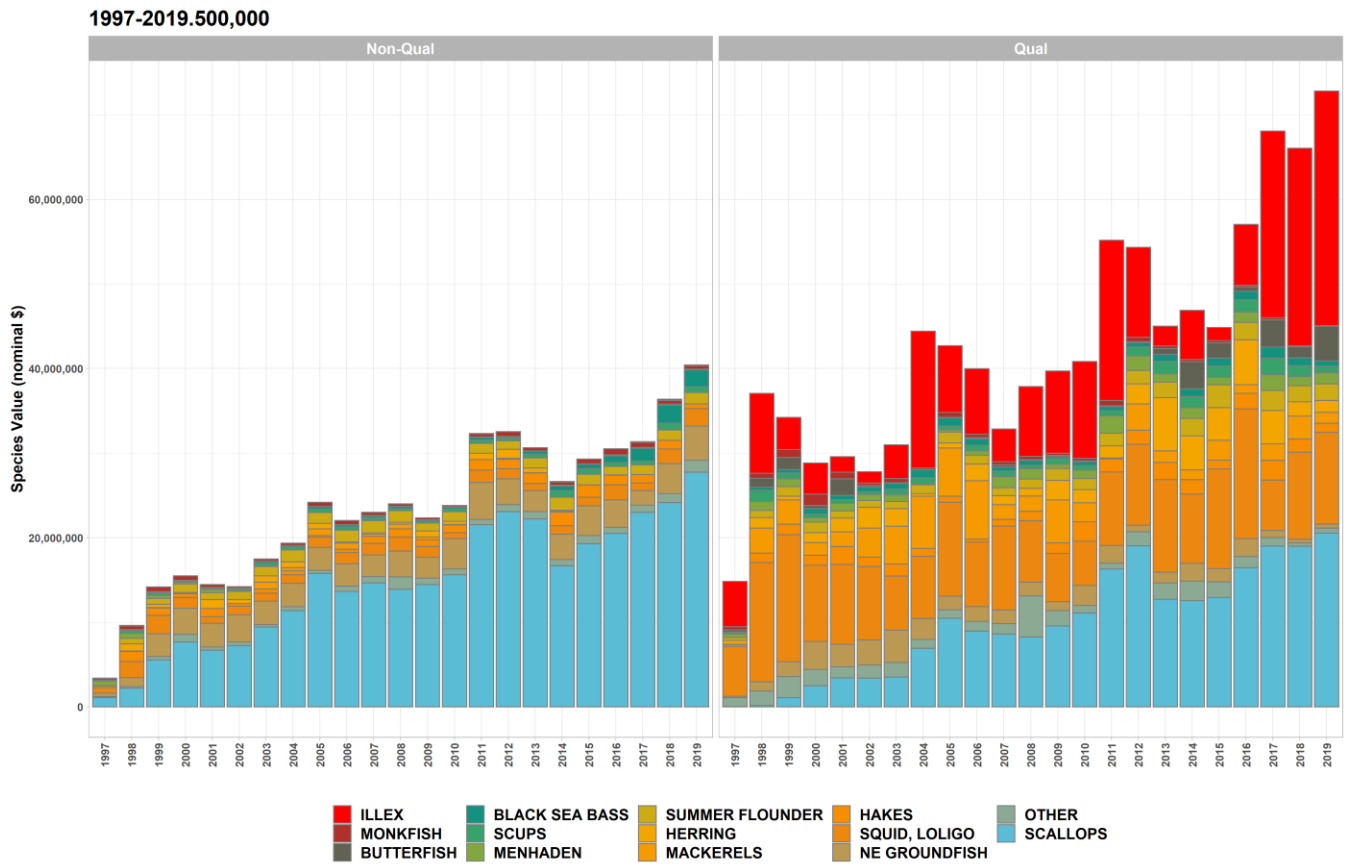
Total species revenues, by year. Species in the top 10 for any year are included. Non-requalifiers are on the left, requalifiers are on the right.

Figure C3. 1997-2019/300K Option Revenues.



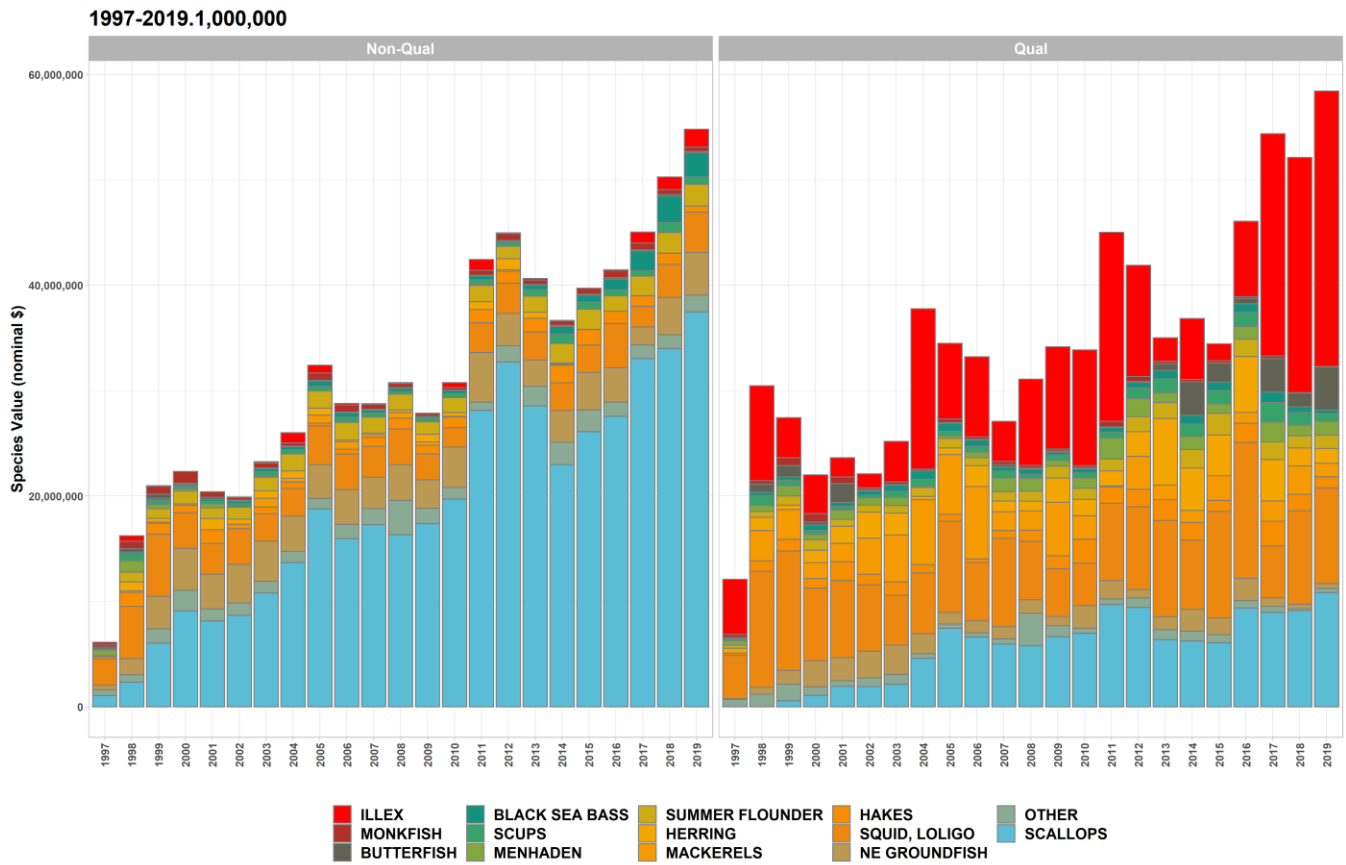
Total species revenues, by year. Species in the top 10 for any year are included. Non-requalifiers are on the left, requalifiers are on the right.

Figure C4. 1997-2019/500K Option Revenues.



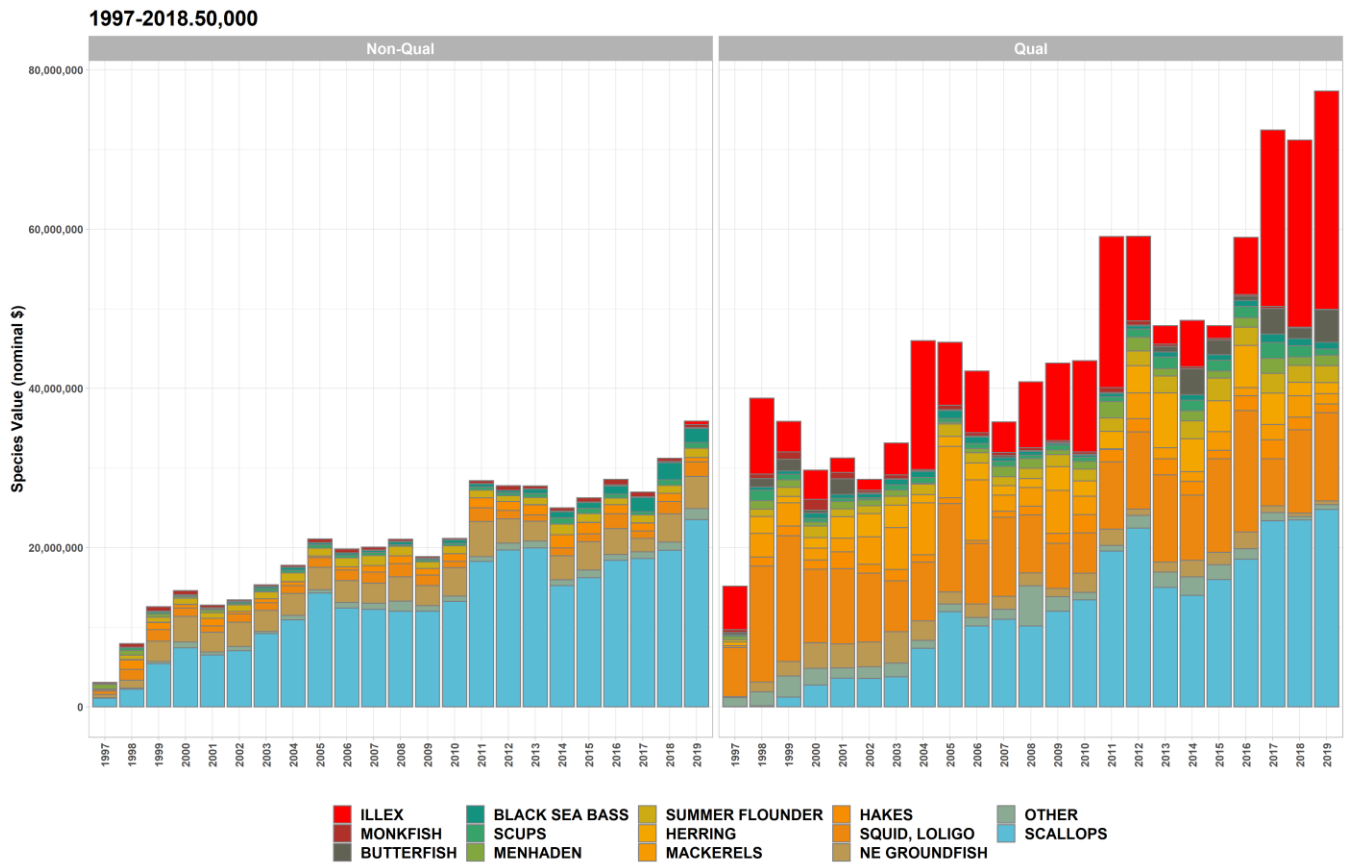
Total species revenues, by year. Species in the top 10 for any year are included. Non-requalifiers are on the left, requalifiers are on the right.

Figure C5. 1997-2019/1,000,000 Option Revenues.



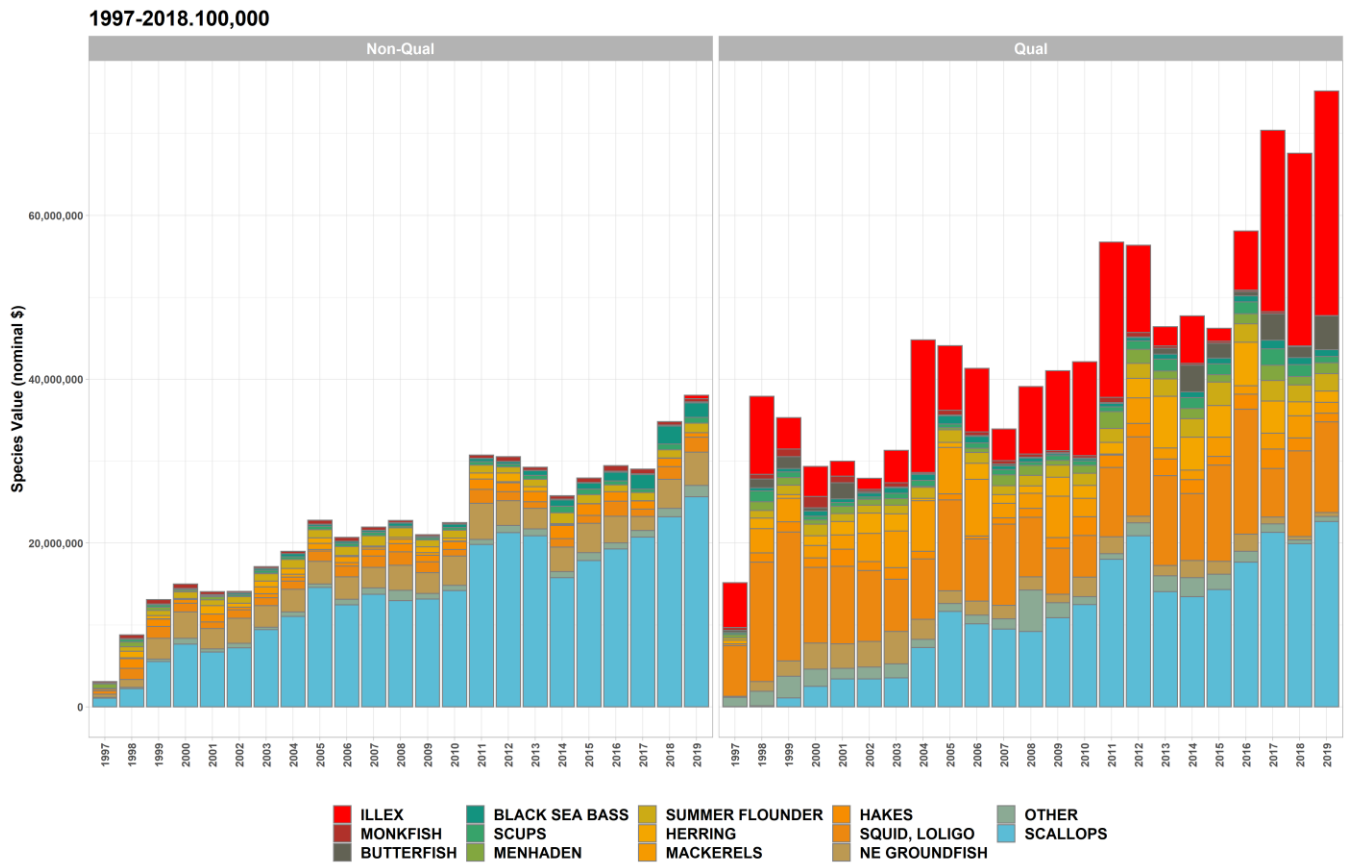
Total species revenues, by year. Species in the top 10 for any year are included. Non-requalifiers are on the left, requalifiers are on the right.

Figure C6. 1997-2018/50K Option Revenues.



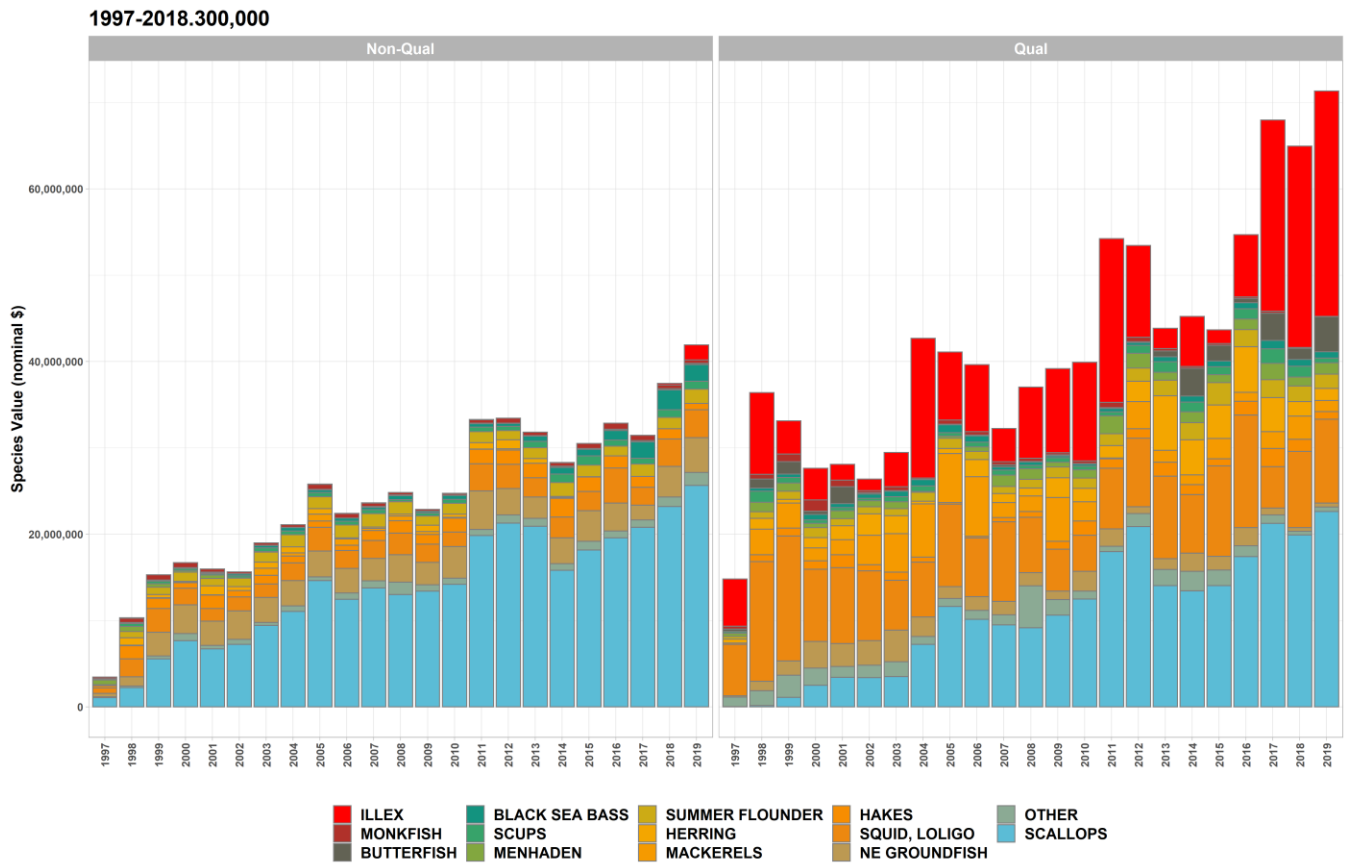
Total species revenues, by year. Species in the top 10 for any year are included. Non-requalifiers are on the left, requalifiers are on the right.

Figure C7. 1997-2018/100K Option Revenues.



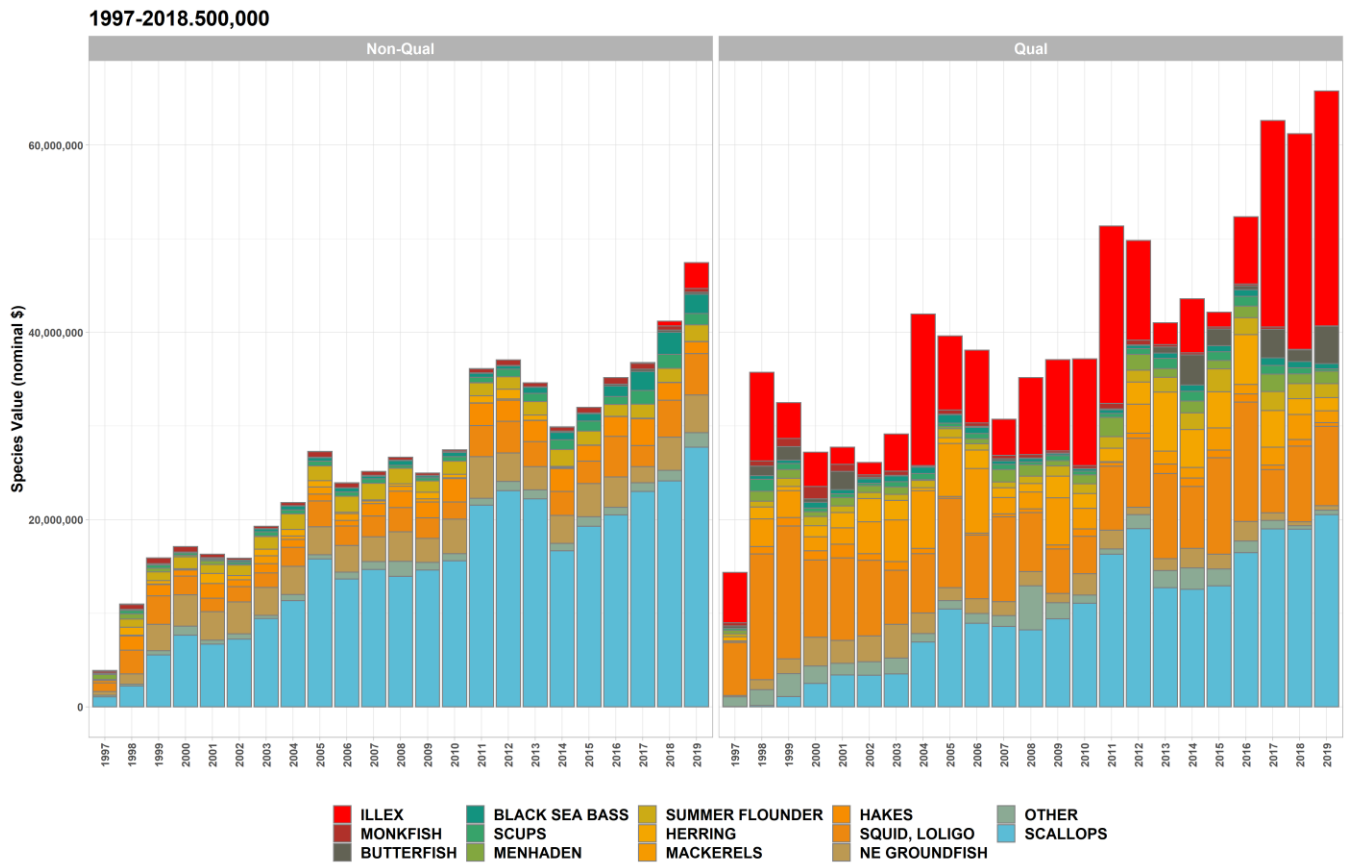
Total species revenues, by year. Species in the top 10 for any year are included. Non-requalifiers are on the left, requalifiers are on the right.

Figure C8. 1997-2018/300K Trip Option Revenues.



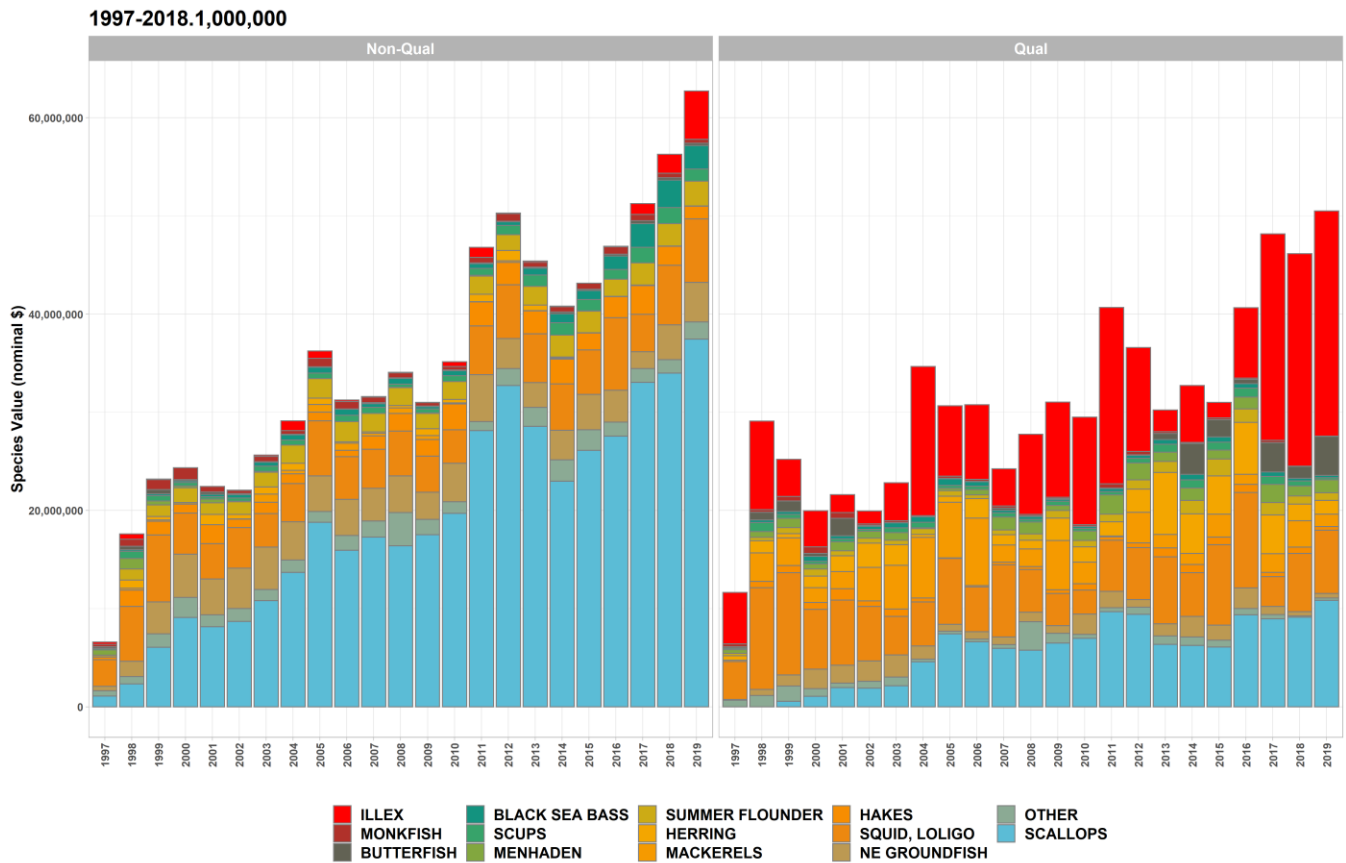
Total species revenues, by year. Species in the top 10 for any year are included. Non-requalifiers are on the left, requalifiers are on the right.

Figure C9. 1997-2018/500K Option Revenues.



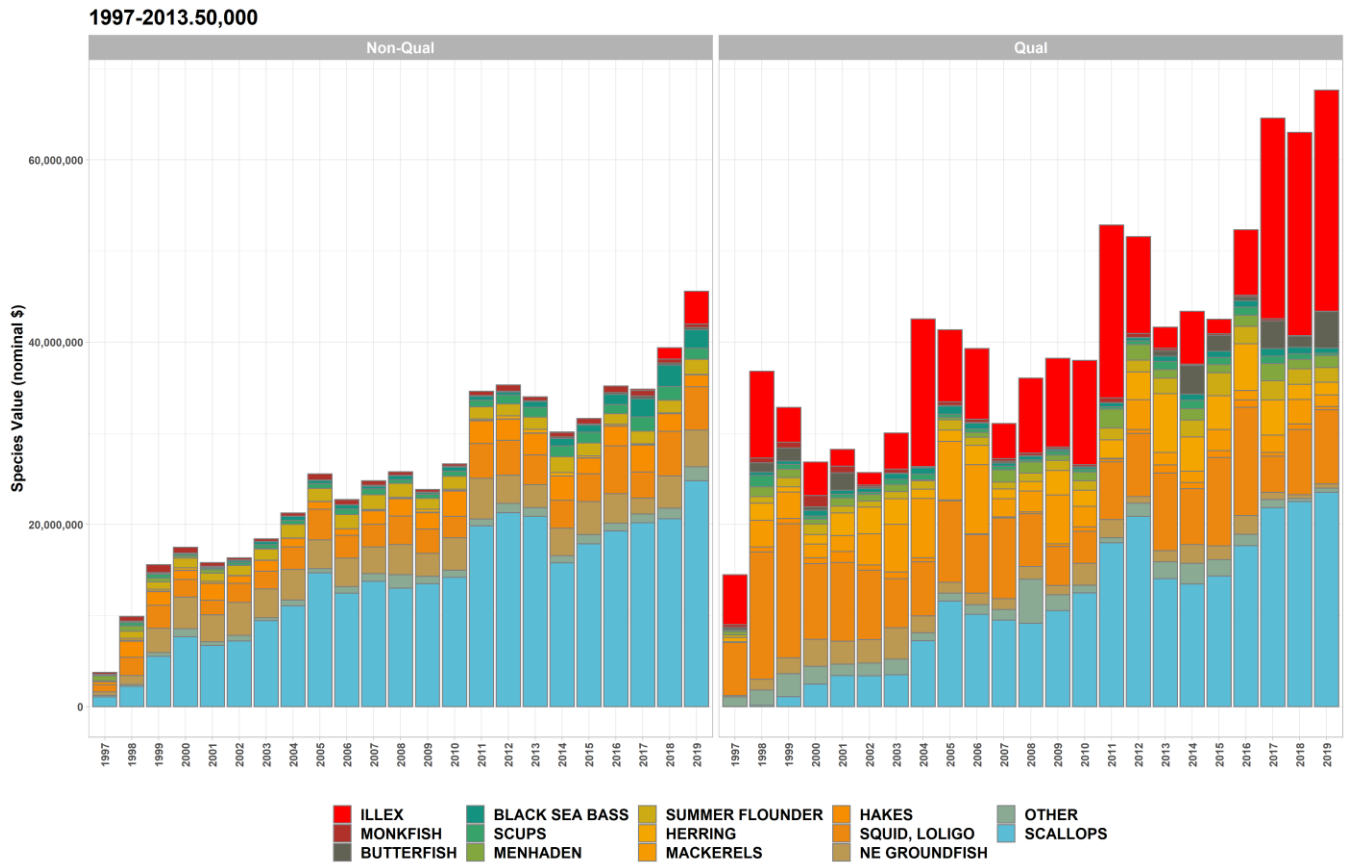
Total species revenues, by year. Species in the top 10 for any year are included. Non-requalifiers are on the left, requalifiers are on the right.

Figure C10. 1997-2018/1,000,000 Option Revenues.



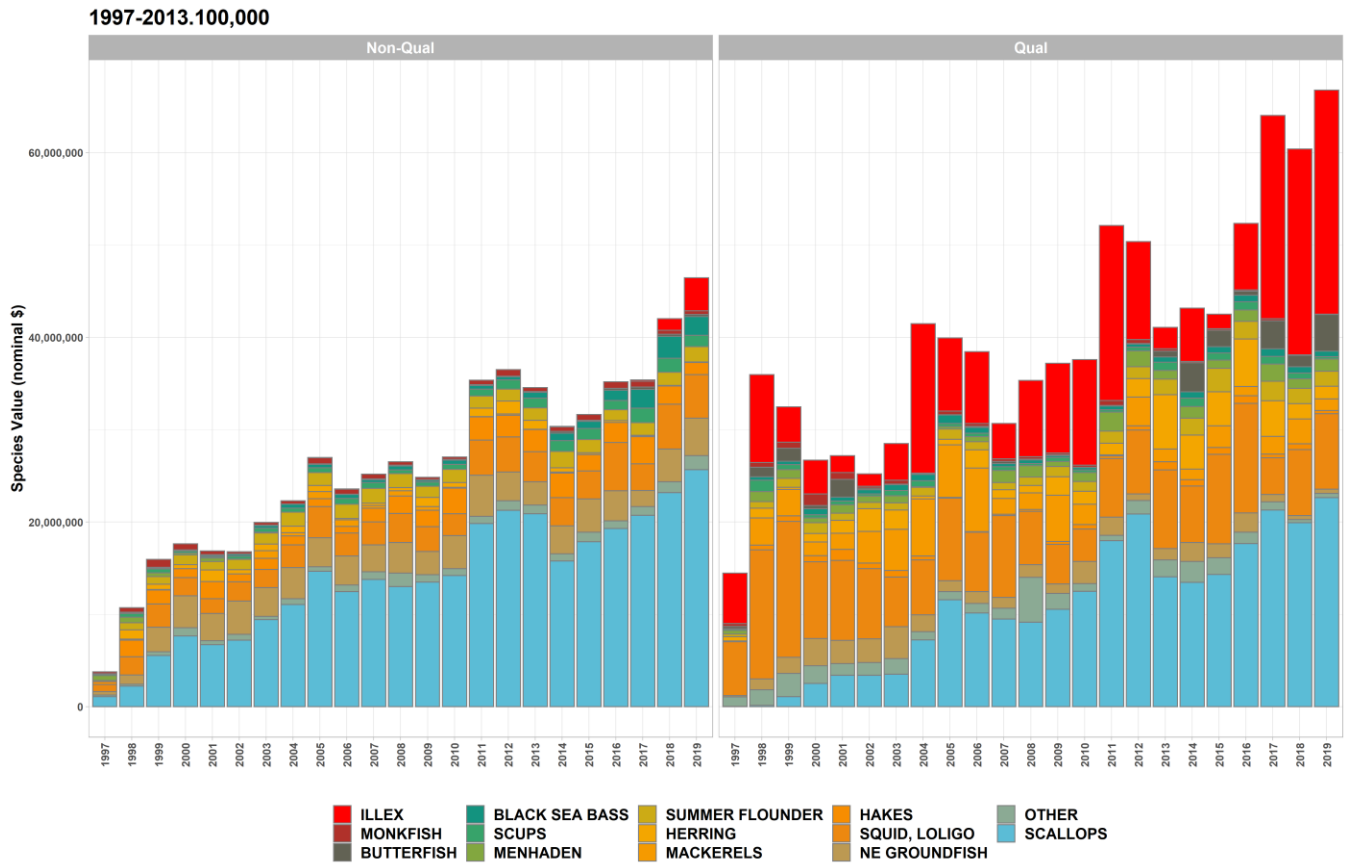
Total species revenues, by year. Species in the top 10 for any year are included. Non-requalifiers are on the left, requalifiers are on the right.

Figure C11. 1997-2013/50K Option Revenues.



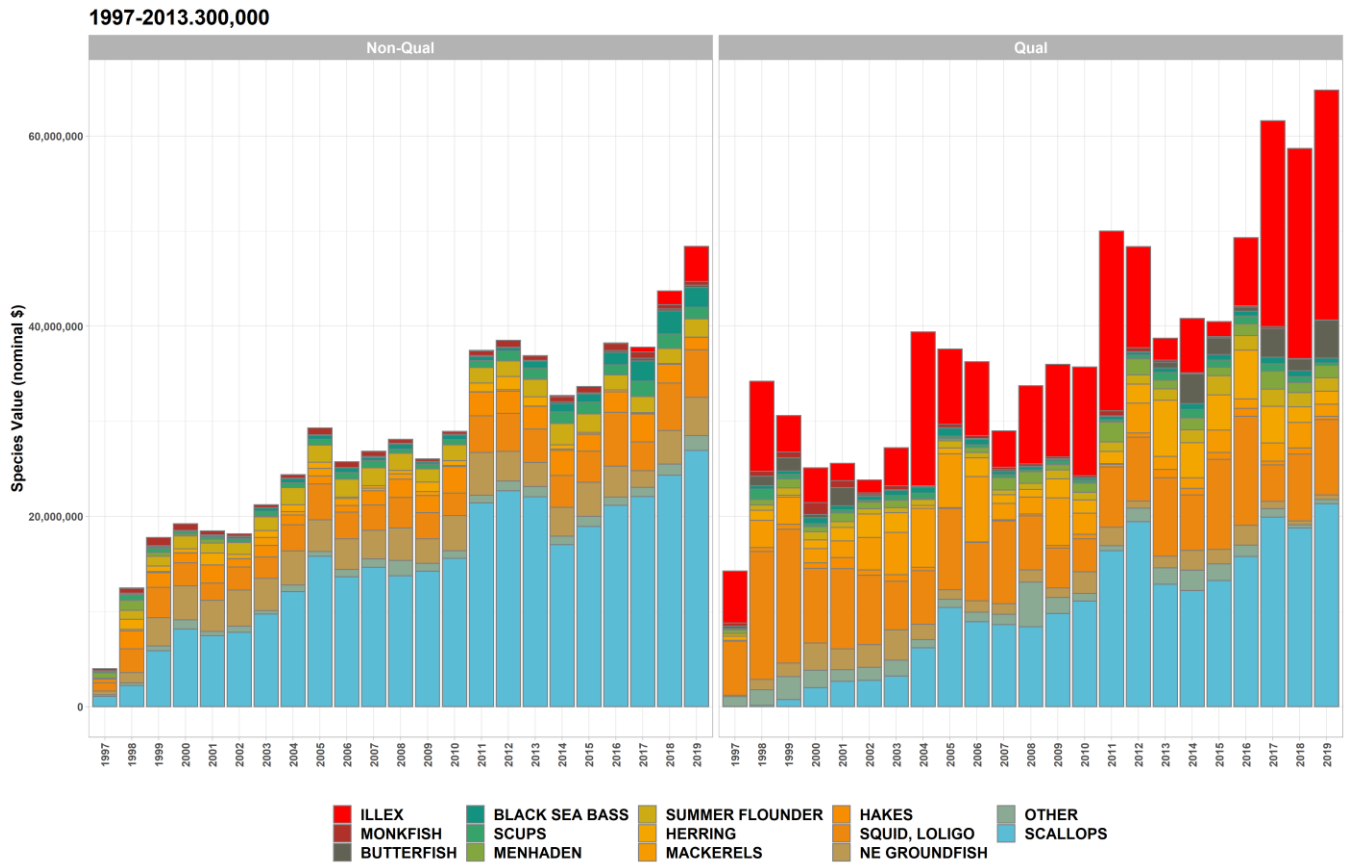
Total species revenues, by year. Species in the top 10 for any year are included. Non-requalifiers are on the left, requalifiers are on the right.

Figure C12. 1997-2013/100K Option Revenues.



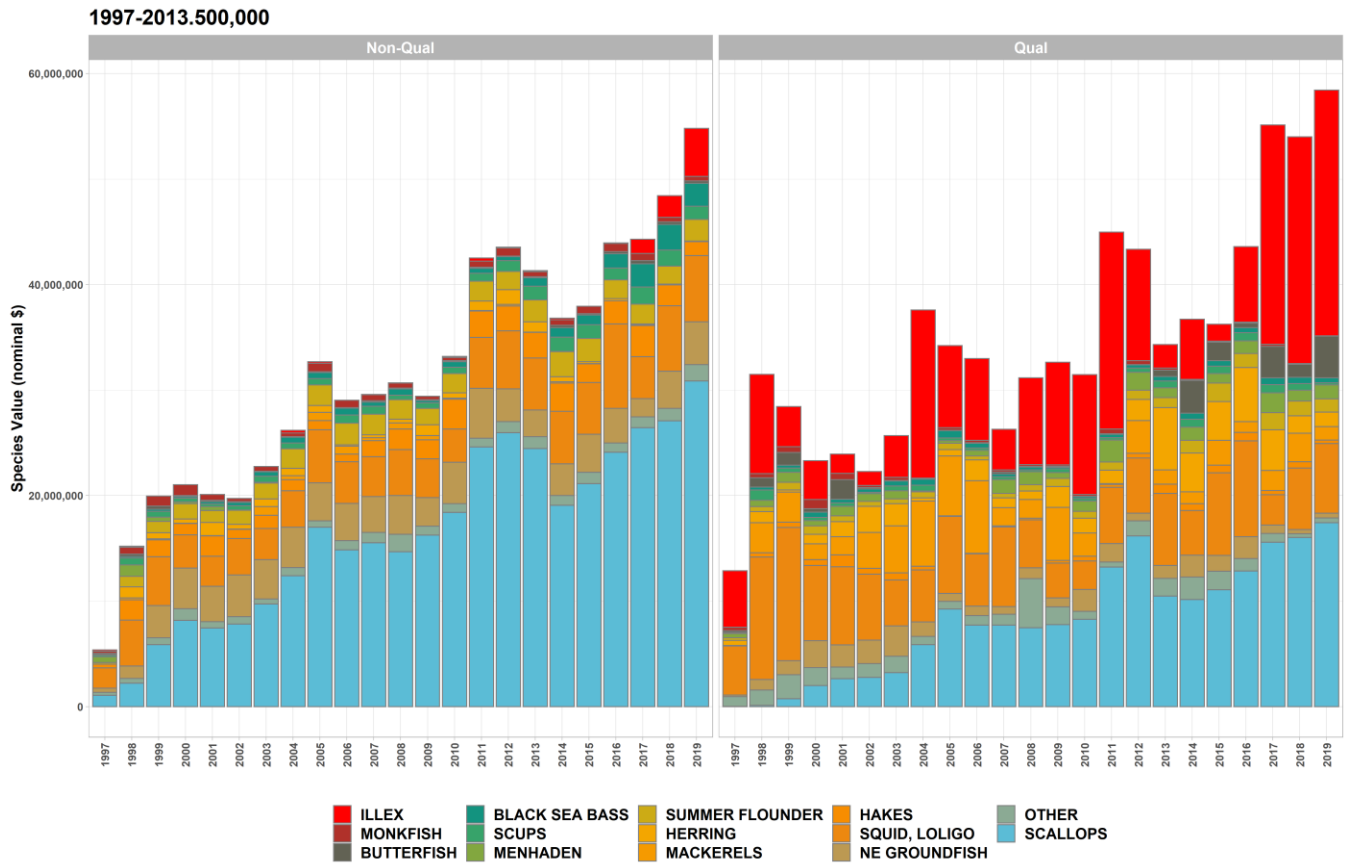
Total species revenues, by year. Species in the top 10 for any year are included. Non-requalifiers are on the left, requalifiers are on the right.

Figure C13. 1997-2013/300K Option Revenues.



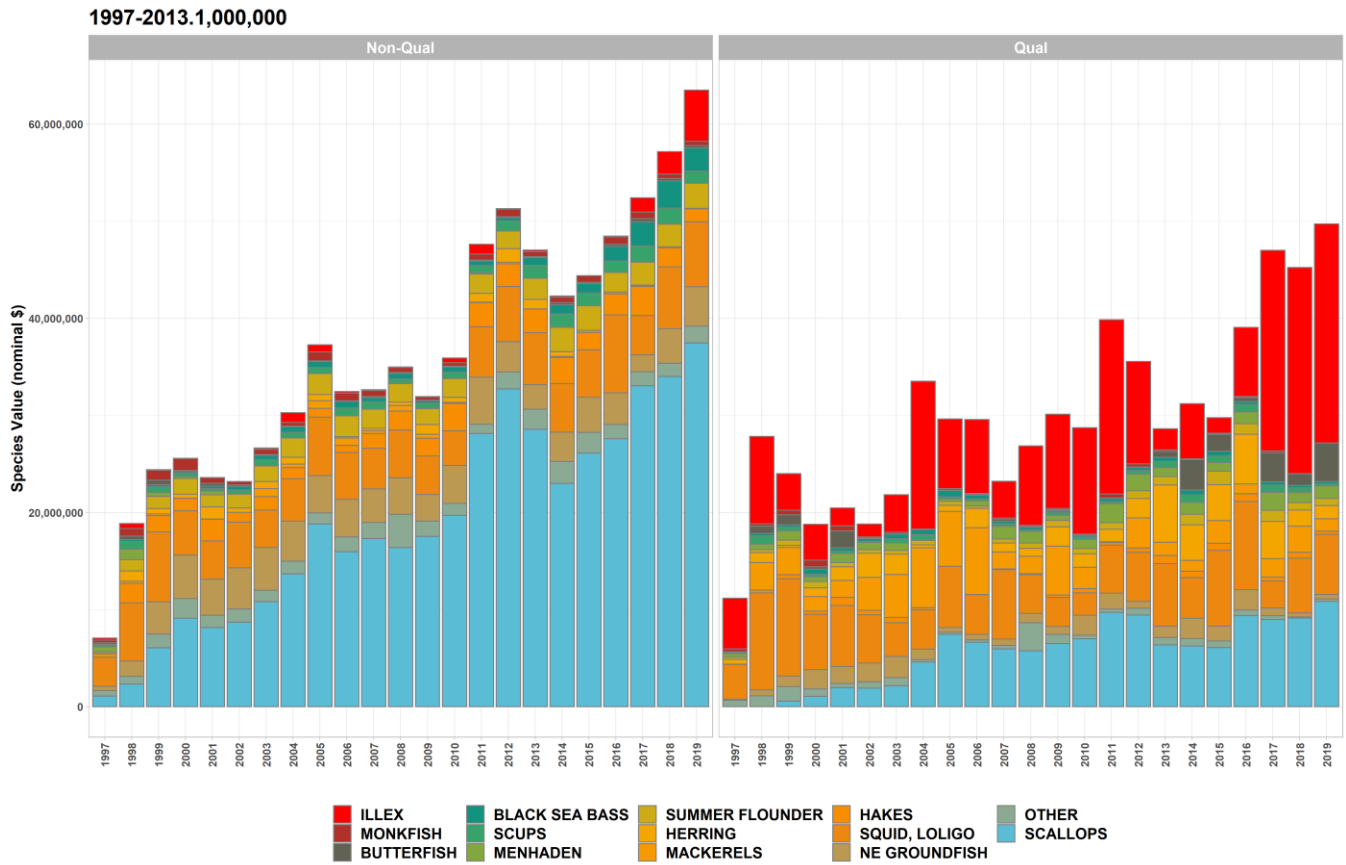
Total species revenues, by year. Species in the top 10 for any year are included. Non-requalifiers are on the left, requalifiers are on the right.

Figure C14. 1997-2013/500K Option Revenues.



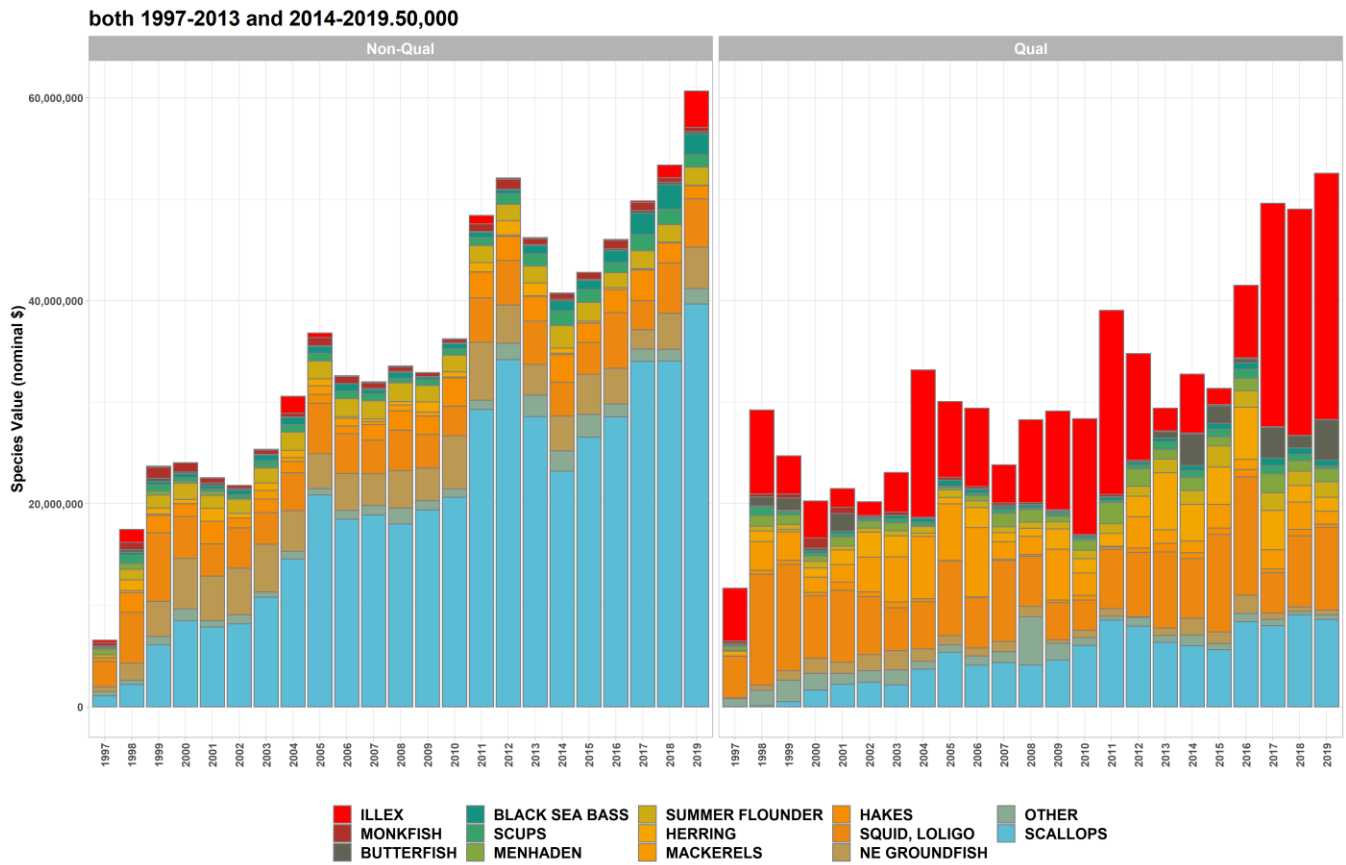
Total species revenues, by year. Species in the top 10 for any year are included. Non-requalifiers are on the left, requalifiers are on the right.

Figure C15. 1997-2013/1,000,000 Option Revenues.



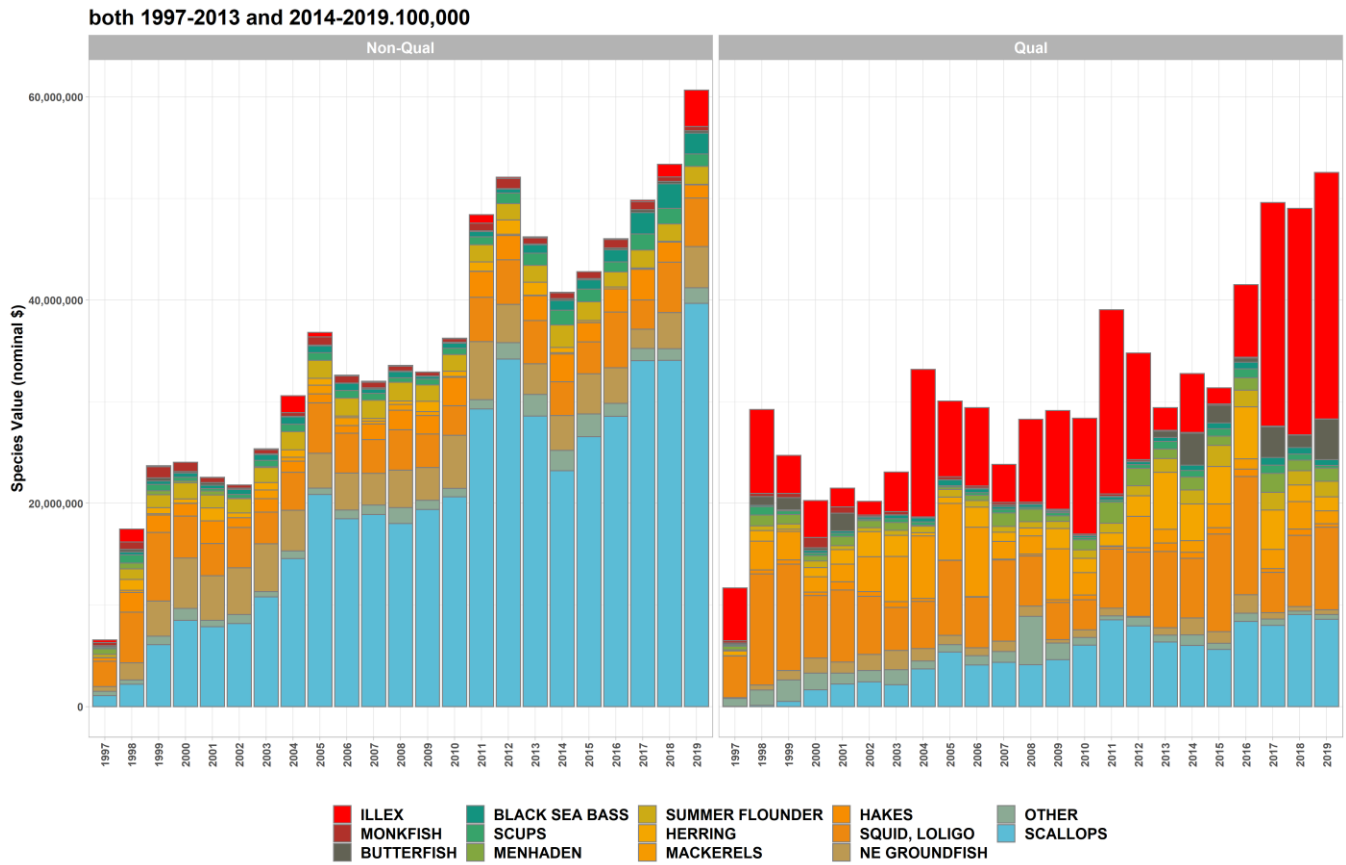
Total species revenues, by year. Species in the top 10 for any year are included. Non-requalifiers are on the left, requalifiers are on the right.

Figure C16. 1997-2013 plus 2014-2019/50K Option Revenues



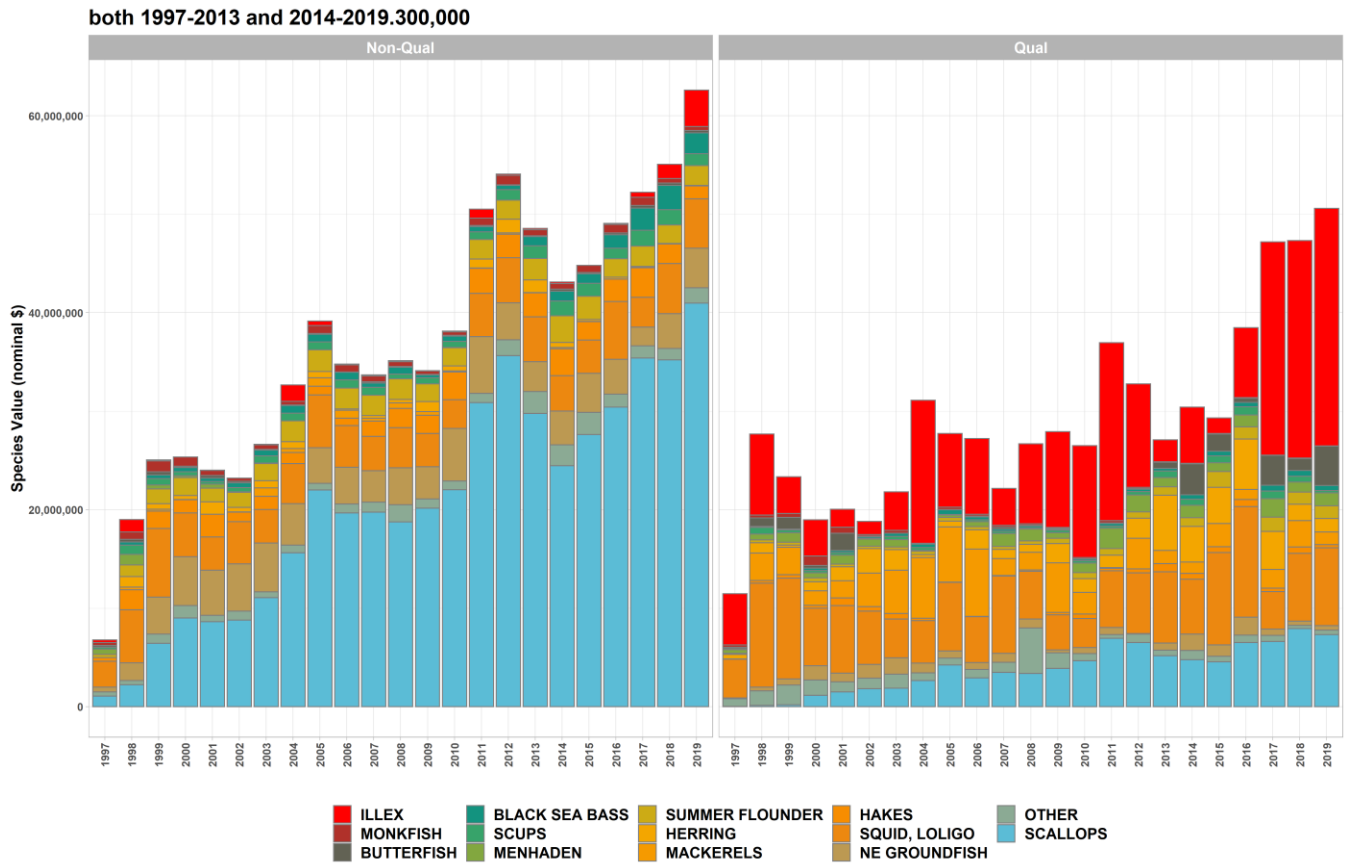
Total species revenues, by year. Species in the top 10 for any year are included. Non-requalifiers are on the left, requalifiers are on the right.

Figure C17. 1997-2013 plus 2014-2019/100K Option Revenues



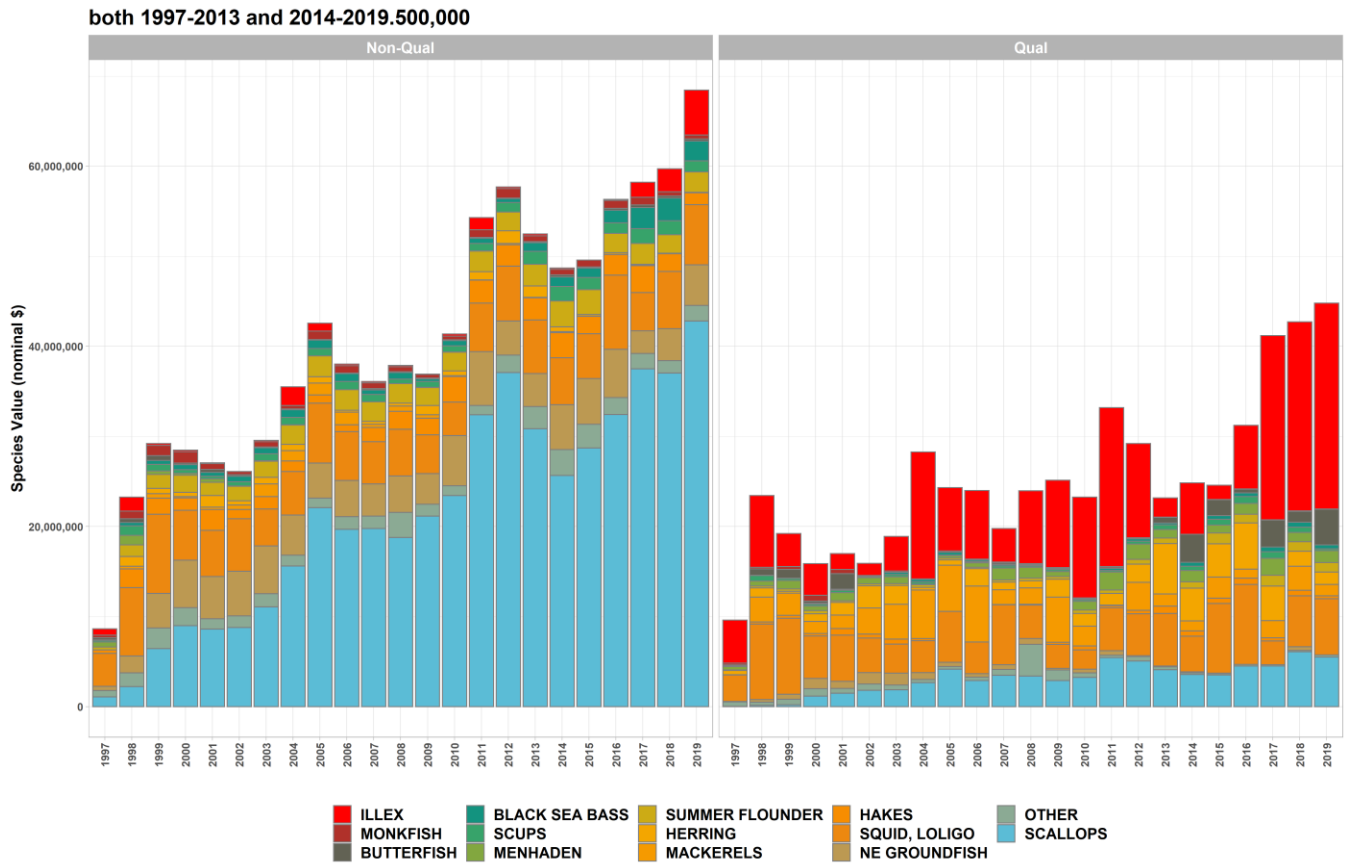
Total species revenues, by year. Species in the top 10 for any year are included. Non-requalifiers are on the left, requalifiers are on the right.

Figure C18. 1997-2013 plus 2014-2019/300K Option Revenues



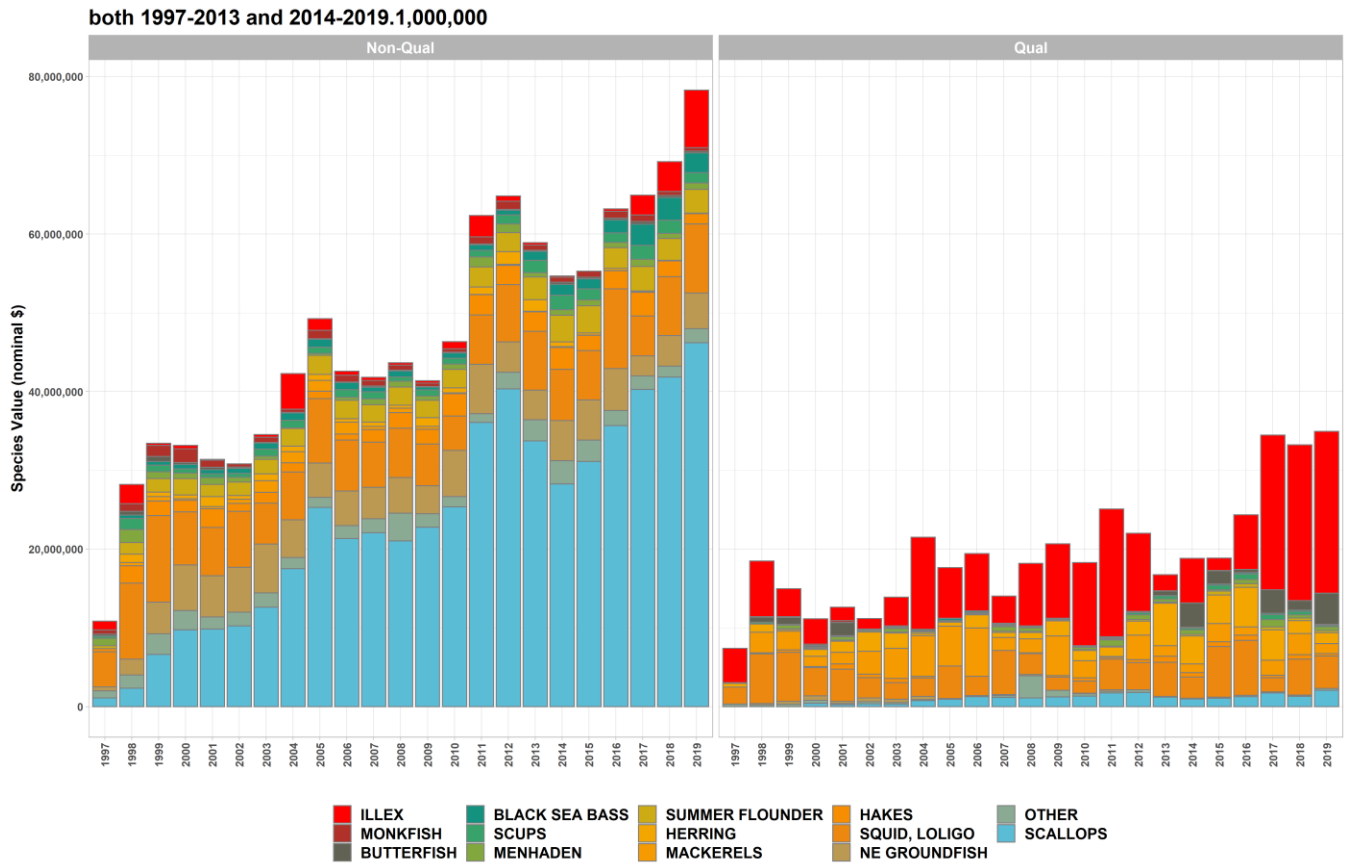
Total species revenues, by year. Species in the top 10 for any year are included. Non-requalifiers are on the left, requalifiers are on the right.

Figure C19. 1997-2013 plus 2014-2019/500K Option Revenues



Total species revenues, by year. Species in the top 10 for any year are included. Non-requalifiers are on the left, requalifiers are on the right.

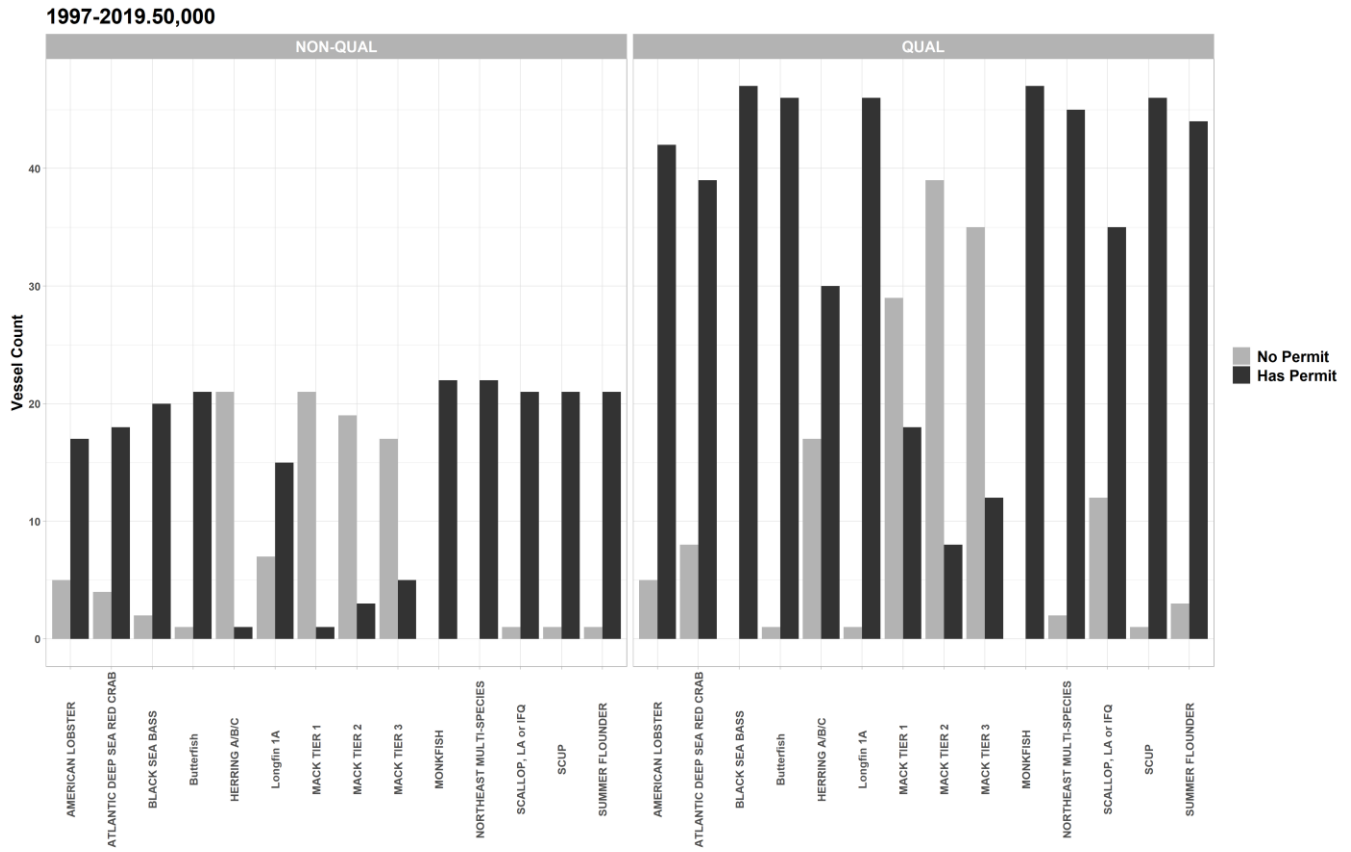
Figure C20. 1997-2013 plus 2014-2019/1,000,000 Option Revenues



Total species revenues, by year. Species in the top 10 for any year are included. Non-requalifiers are on the left, requalifiers are on the right.

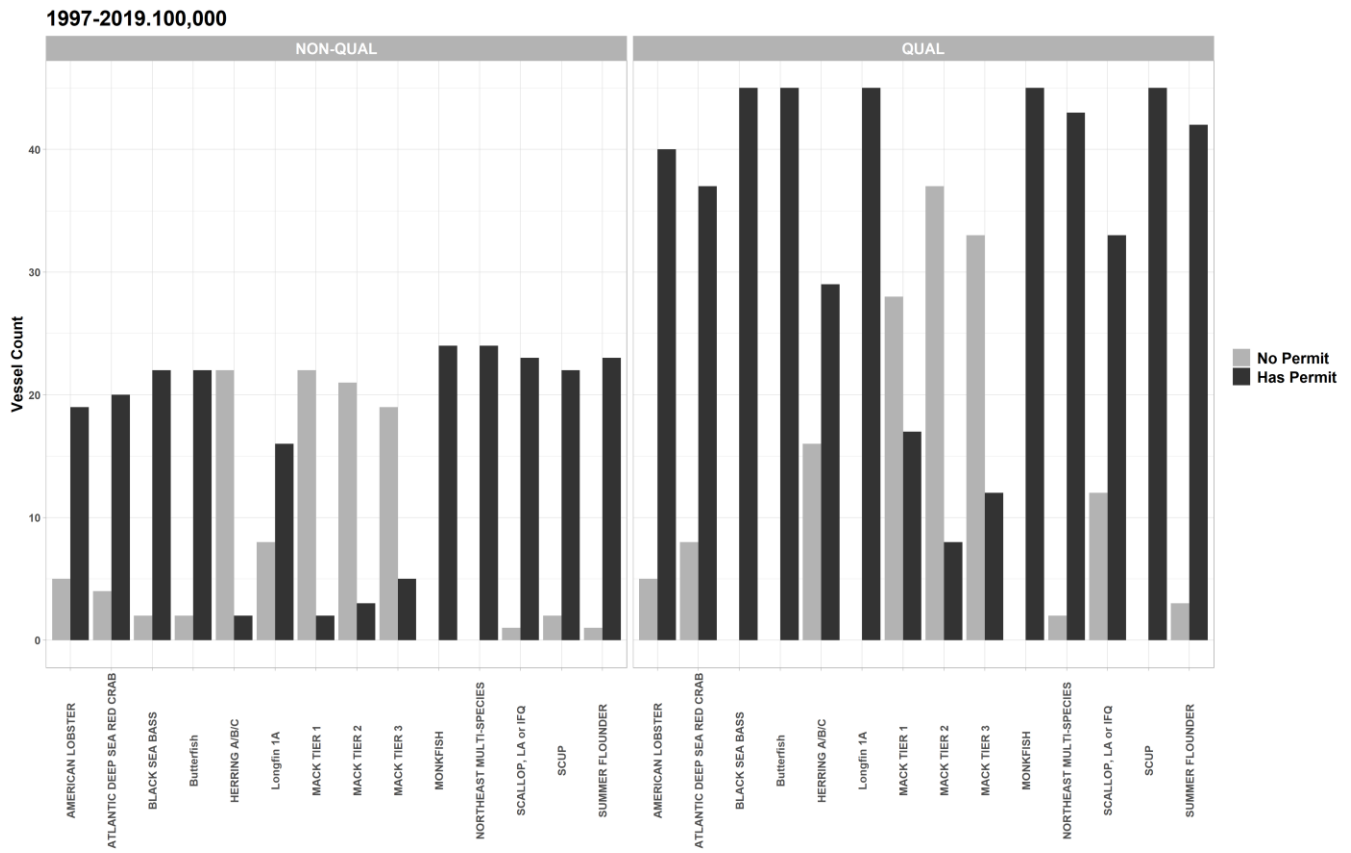
Appendix D. Permits held by Non-Requalifiers and Requalifiers

Figure D1. 1997-2019/50K Option Permits.



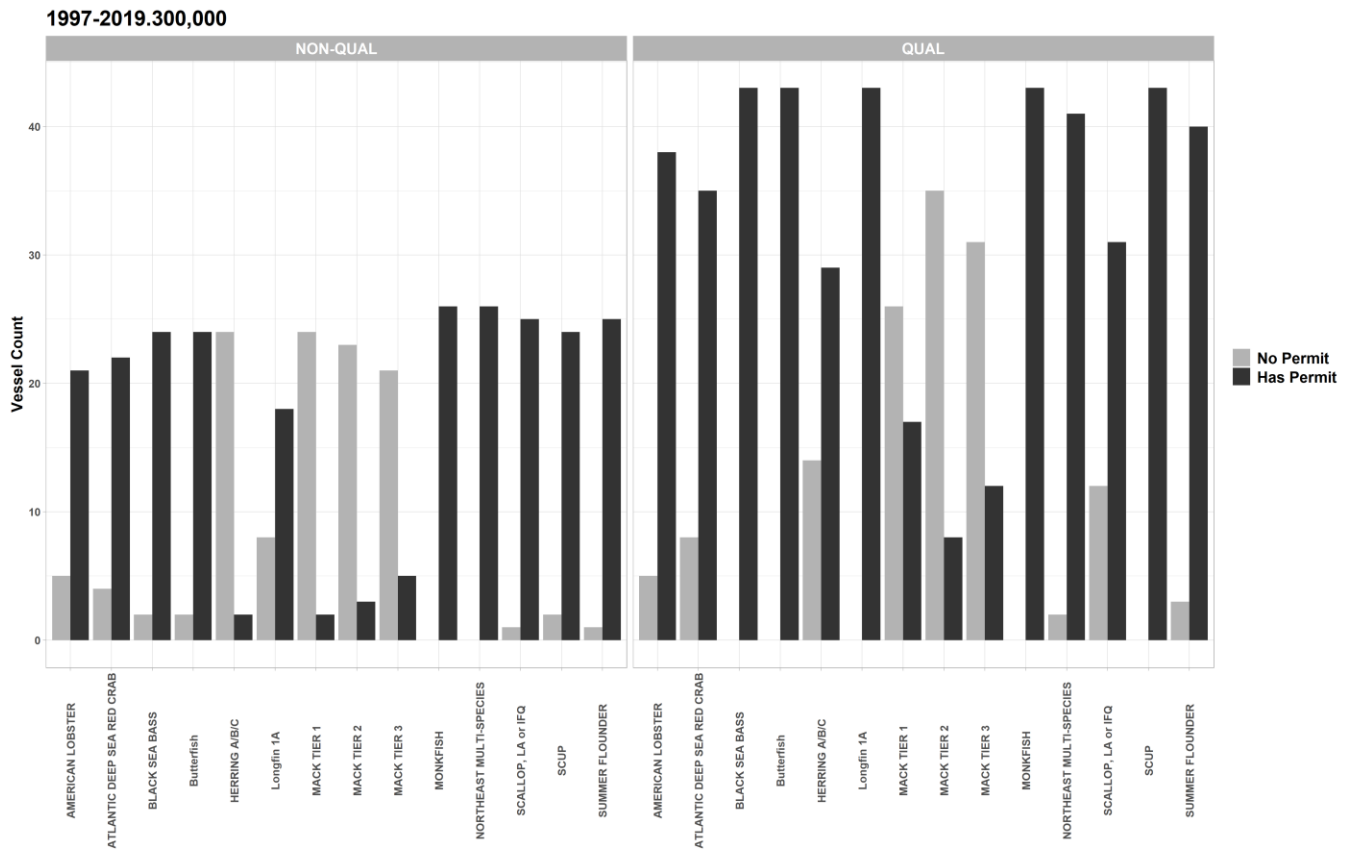
Non-requalifiers' current permits are on the left, requalifiers' are on the right.

Figure D2. 1997-2019/100K Option Permits.



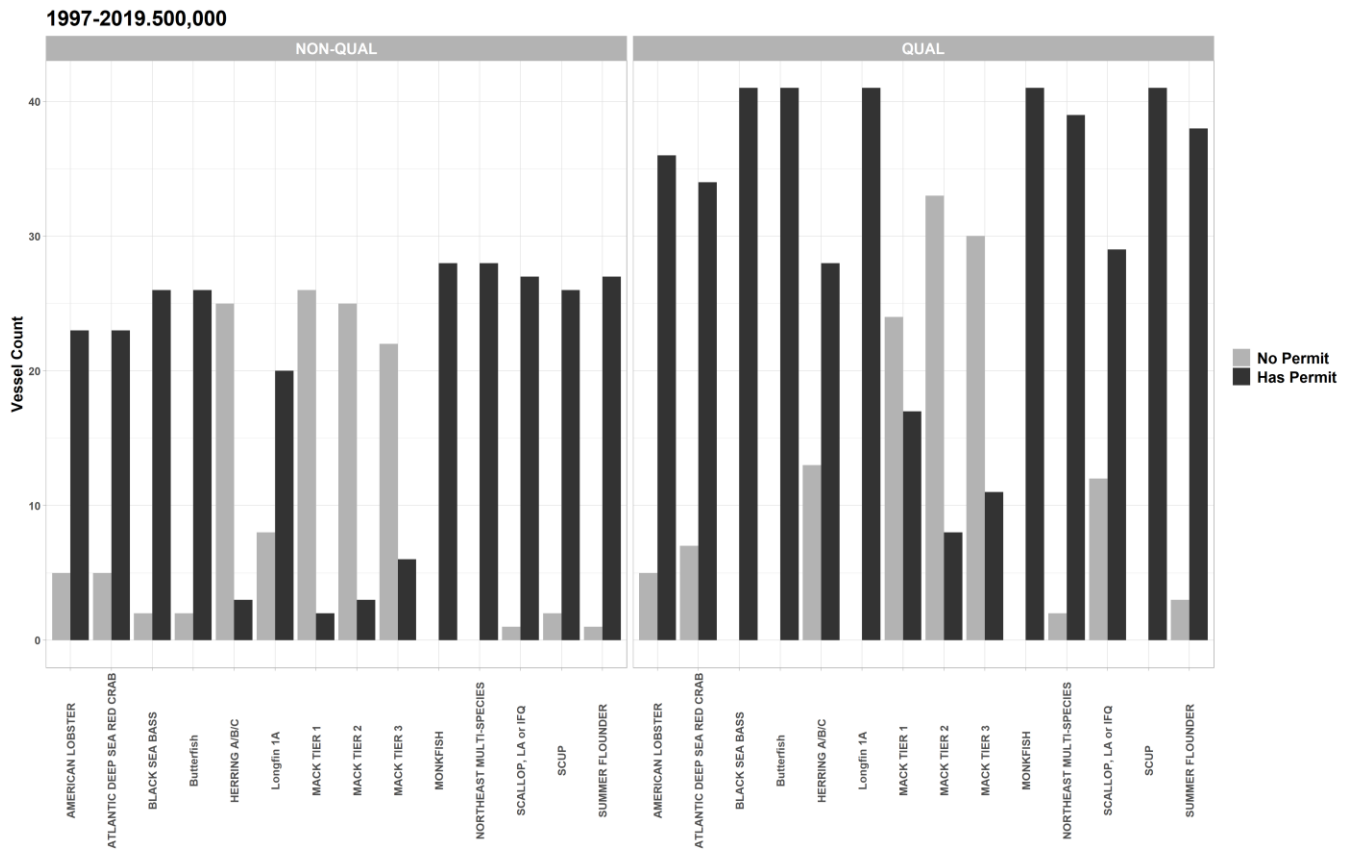
Non-qualifiers' current permits are on the left, qualifiers' are on the right.

Figure D3. 1997-2019/300K Option Permits.



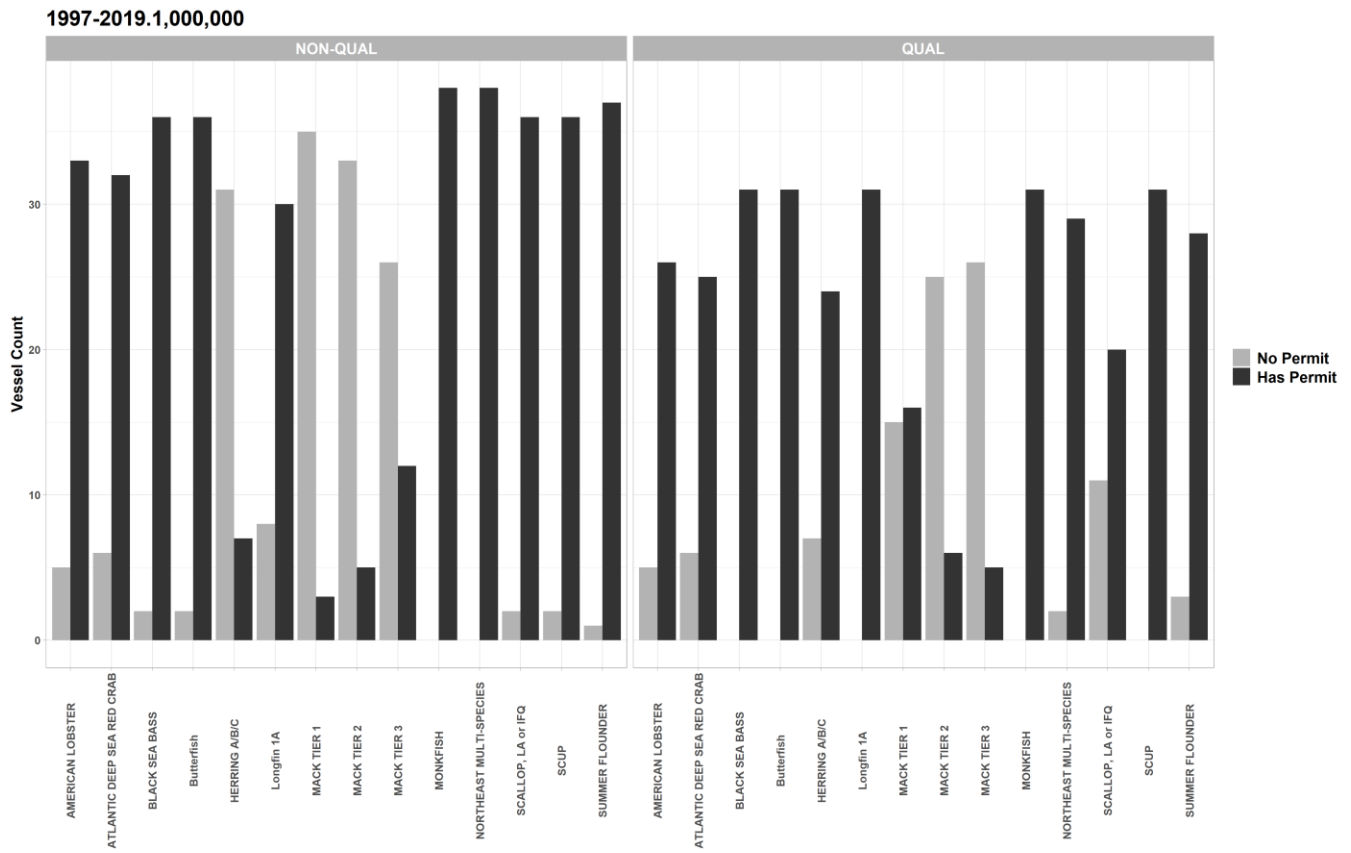
Non-requalifiers' current permits are on the left, requalifiers' are on the right.

Figure D4. 1997-2019/500K Option Permits.



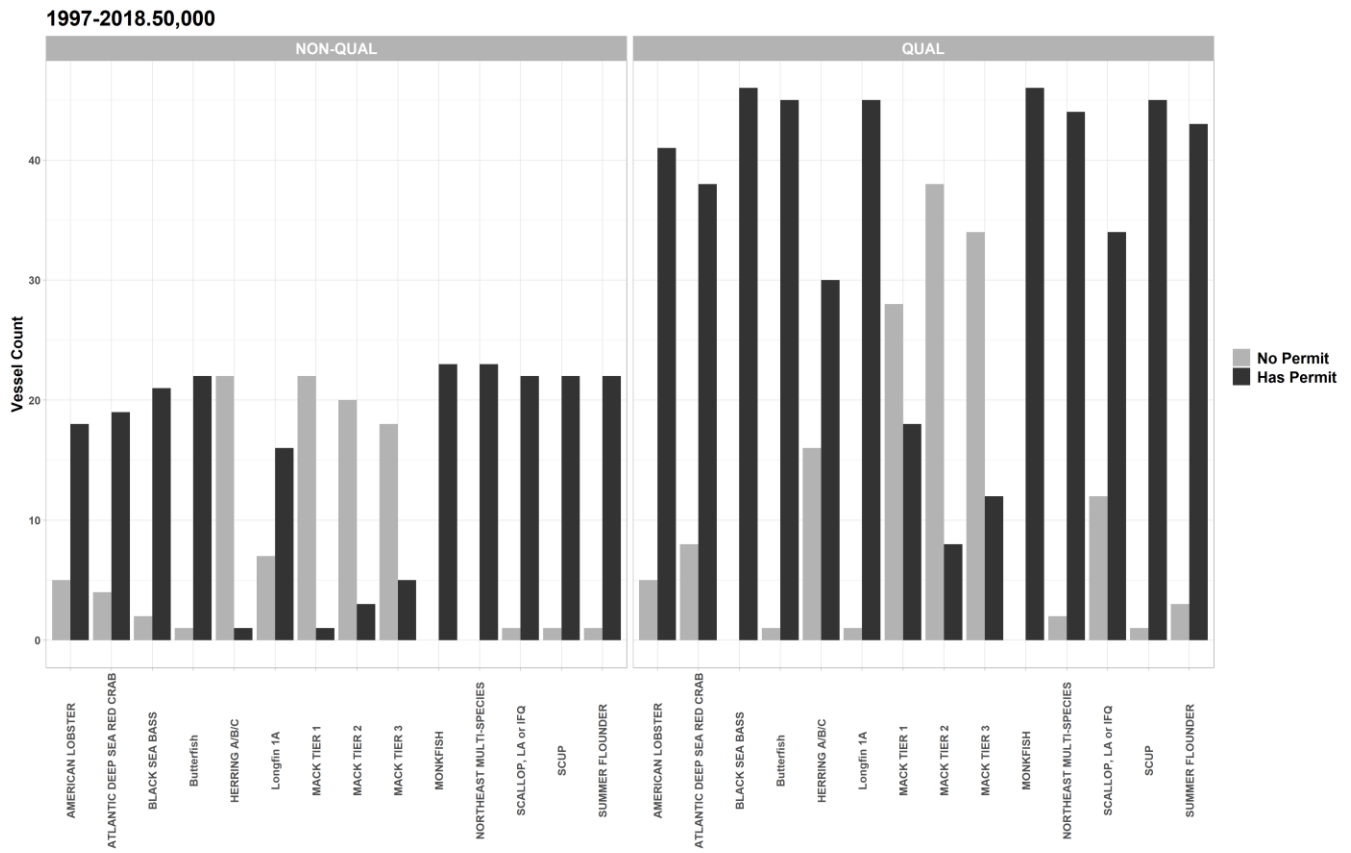
Non-requalifiers' current permits are on the left, requalifiers' are on the right.

Figure D5. 1997-2019/1,000,000 Option Permits.



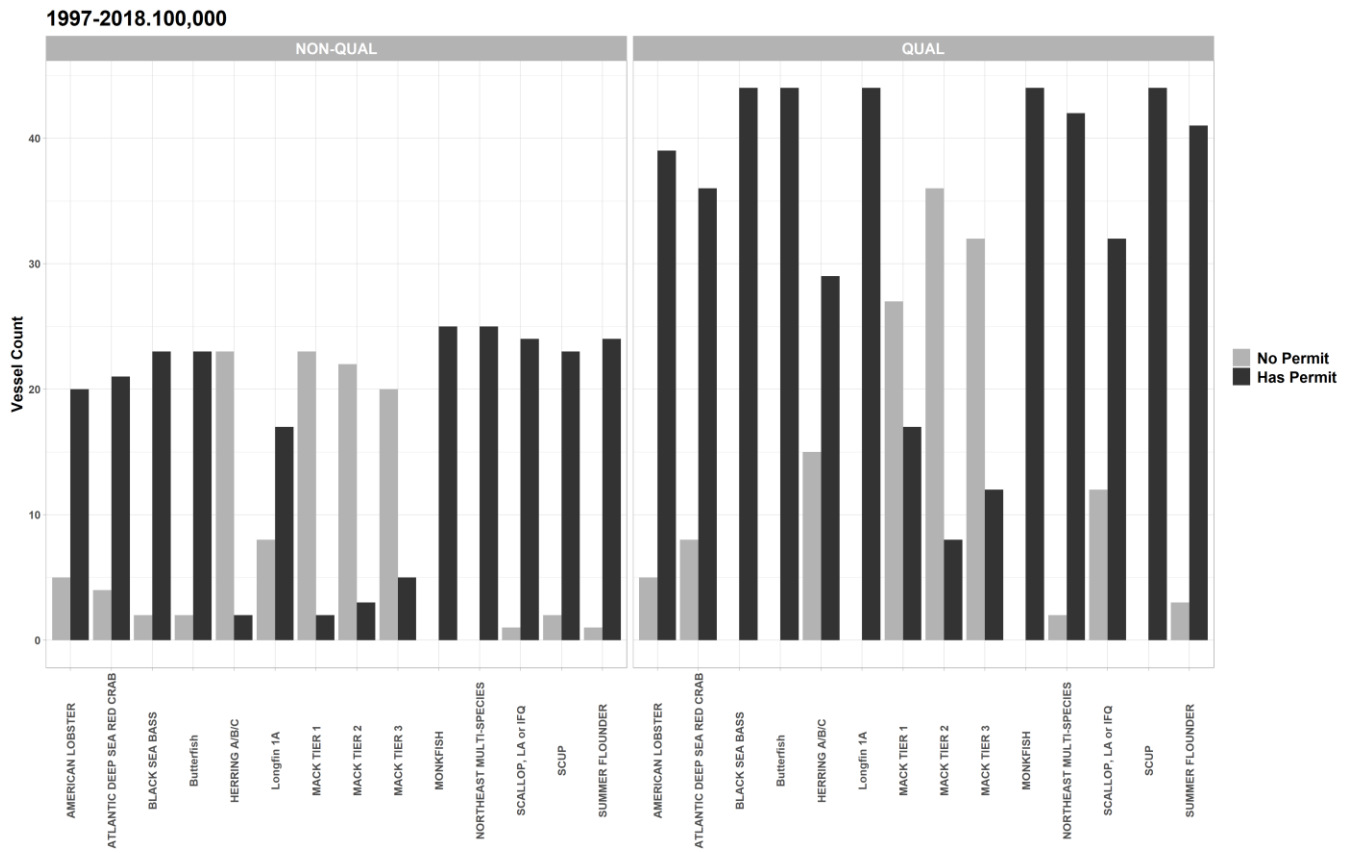
Non-requalifiers' current permits are on the left, requalifiers' are on the right.

Figure D6. 1997-2018/50K Option Permits.



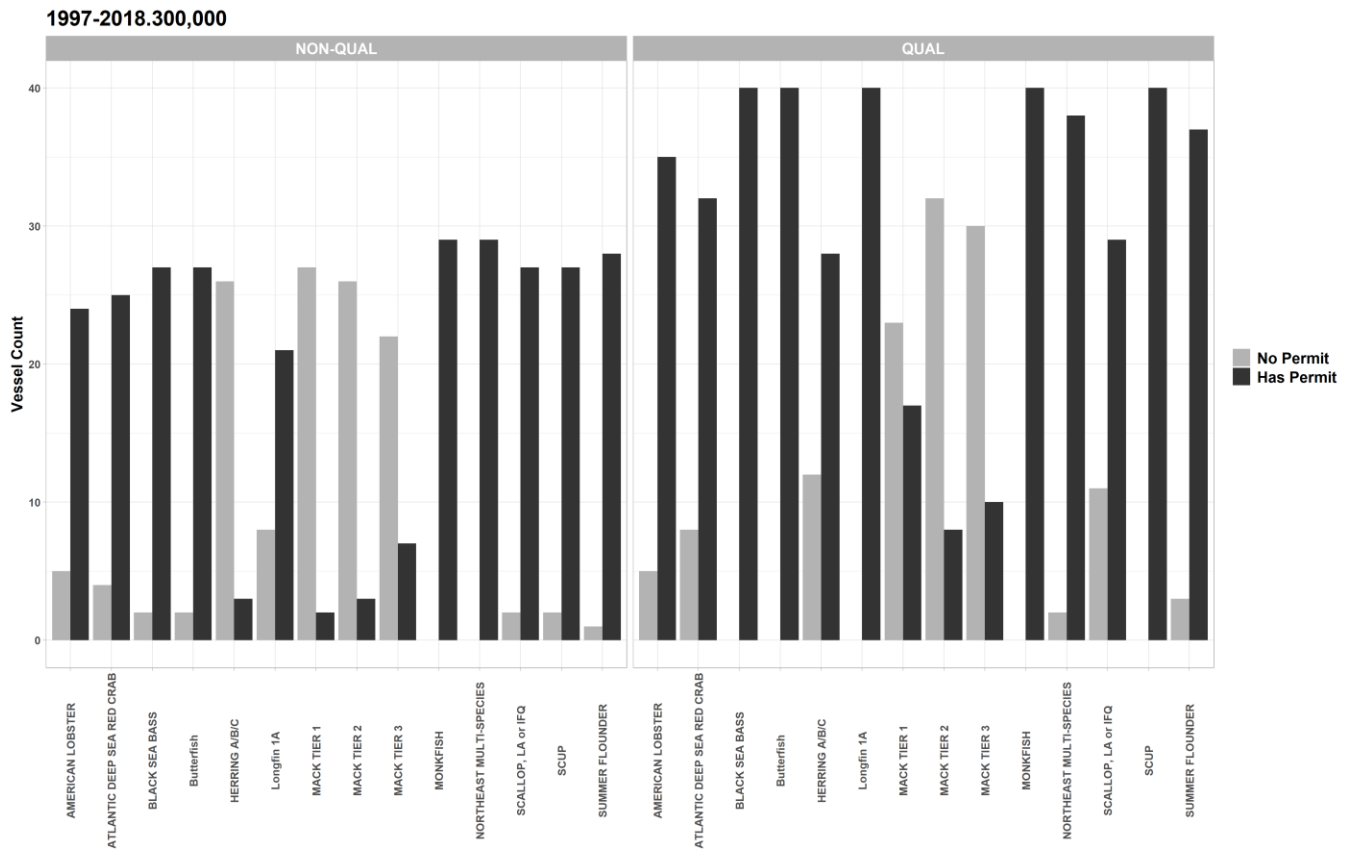
Non-requalifiers' current permits are on the left, requalifiers' are on the right.

Figure D7. 1997-2018/100K Option Permits.



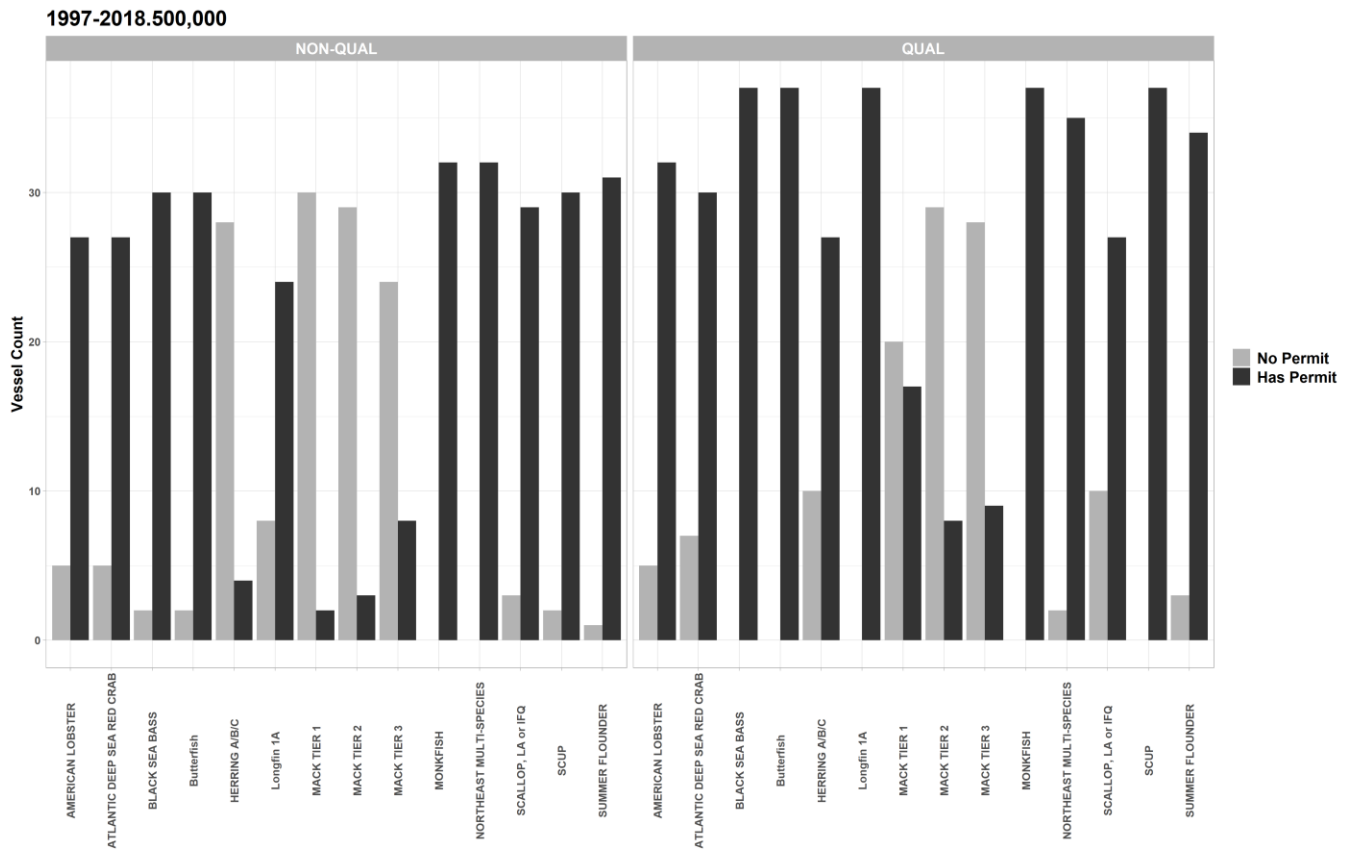
Non-requalifiers' current permits are on the left, requalifiers' are on the right.

Figure D8. 1997-2018/300K Trip Option Permits.



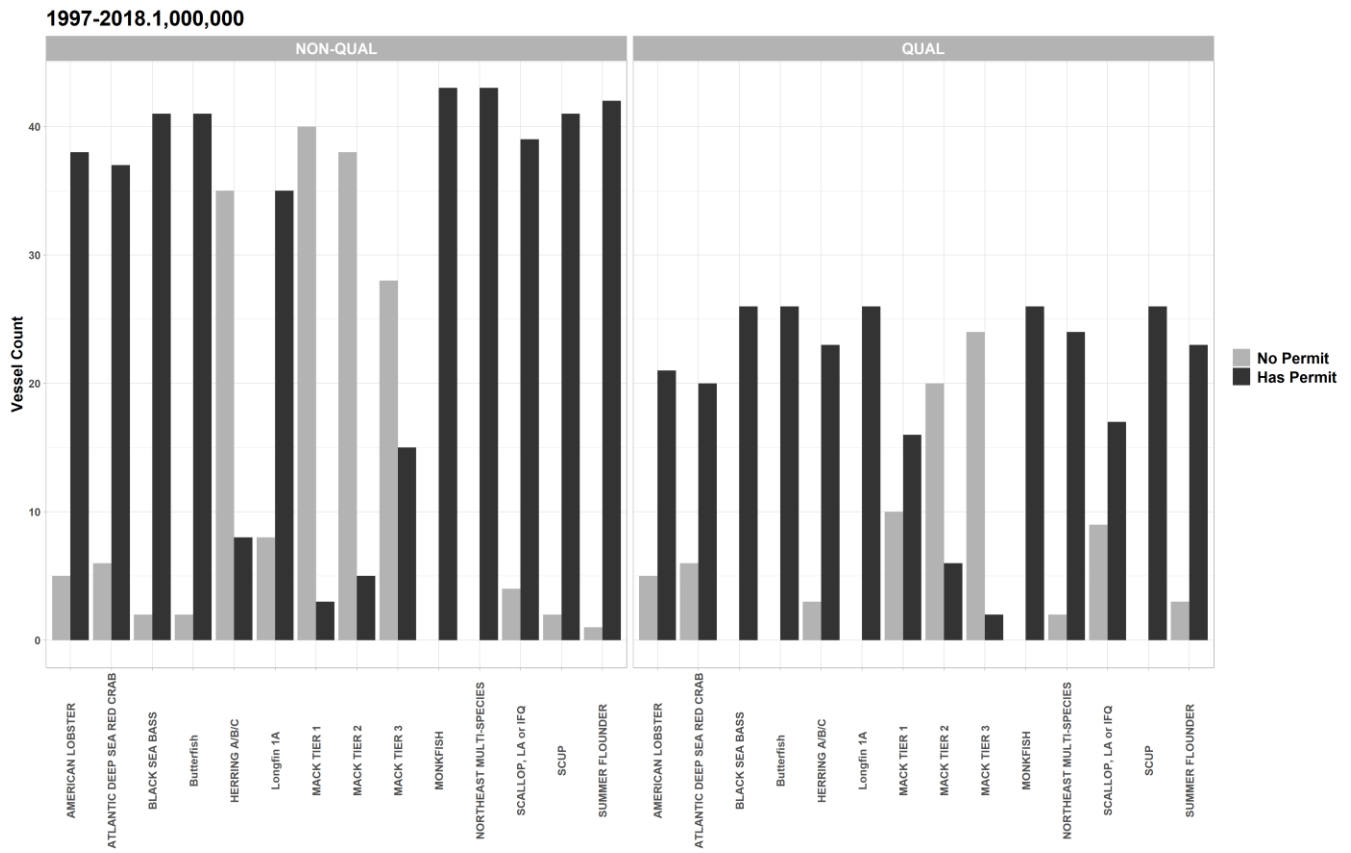
Non-requalifiers' current permits are on the left, requalifiers' are on the right.

Figure D9. 1997-2018/500K Option Permits.



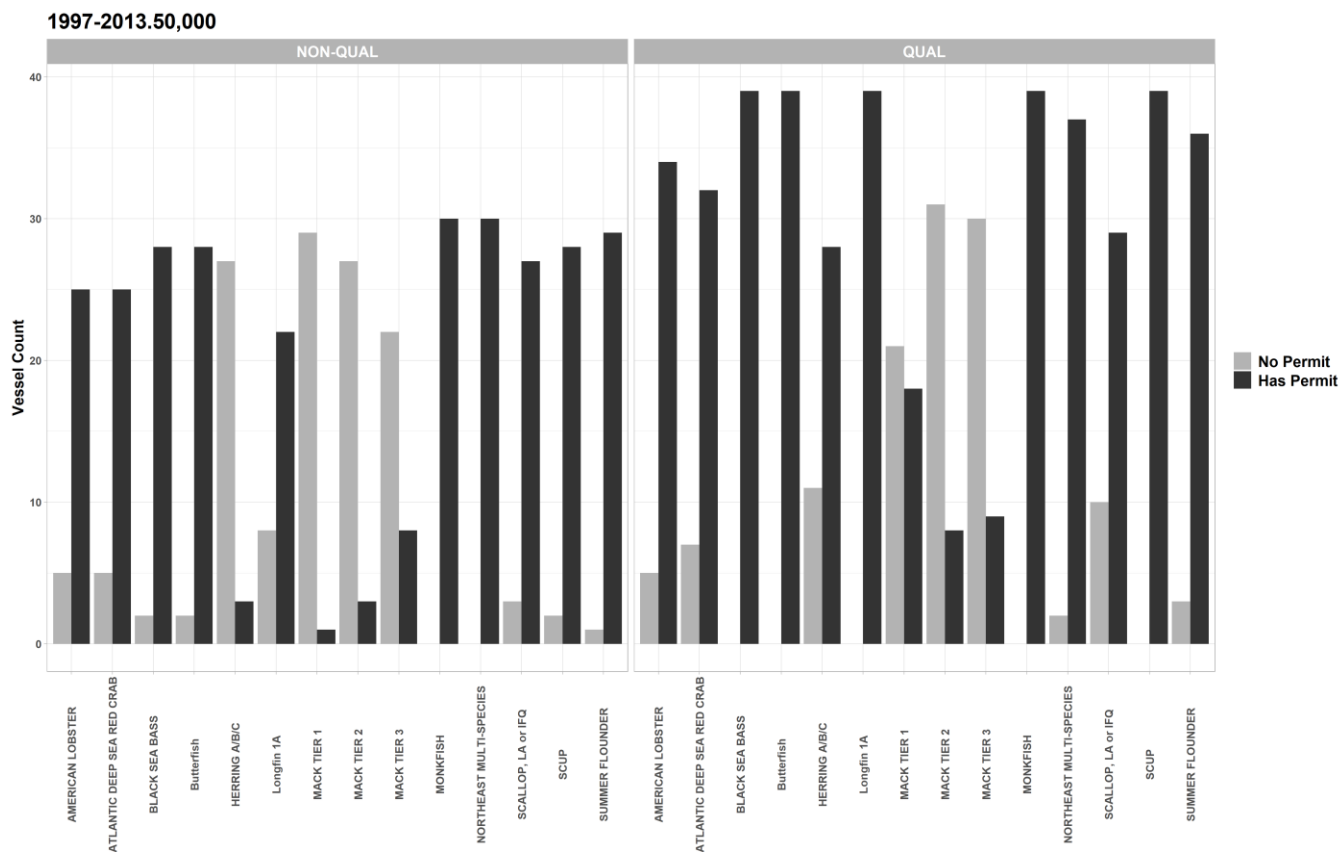
Non-requalifiers' current permits are on the left, requalifiers' are on the right.

Figure D10. 1997-2018/1,000,000 Option Permits.



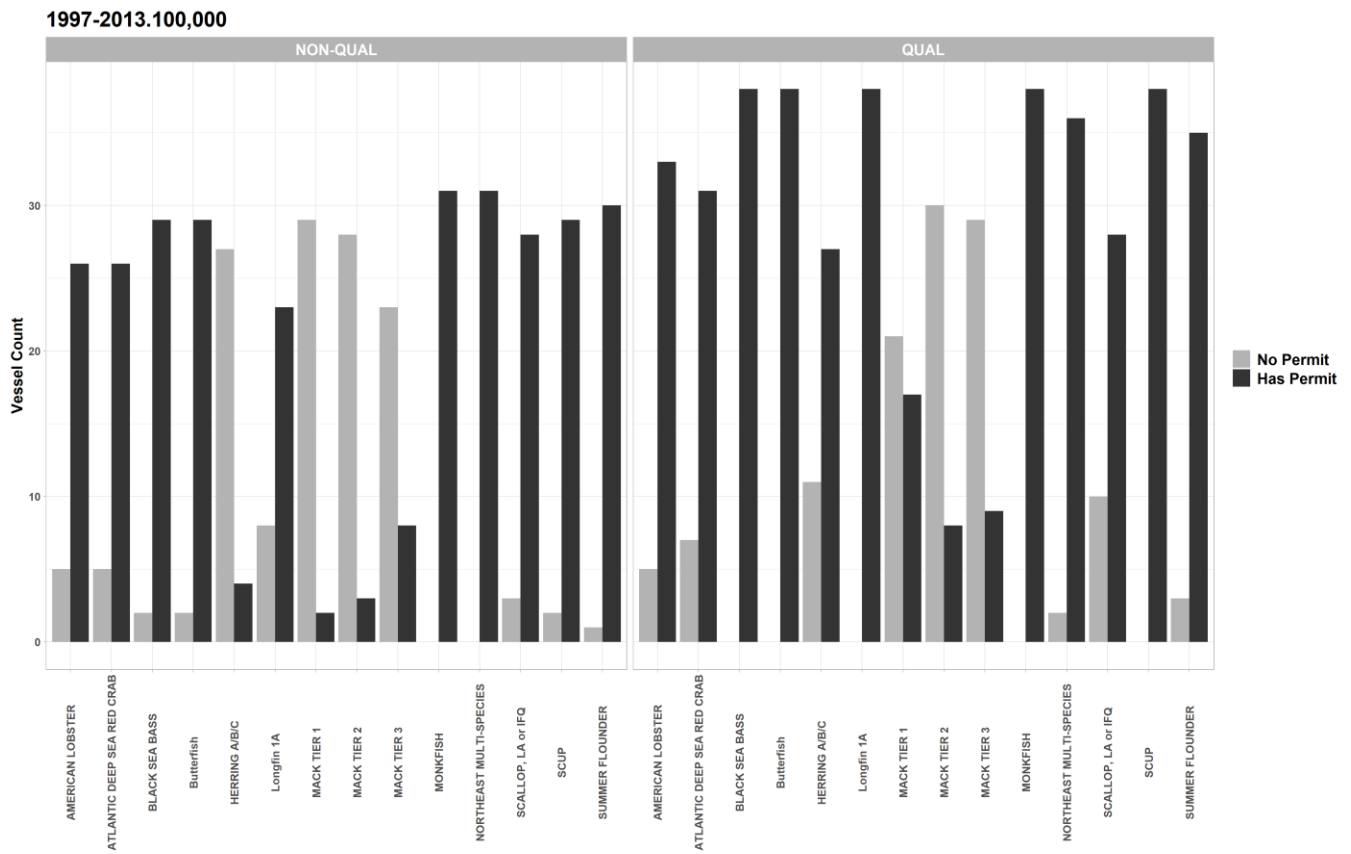
Non-requalifiers' current permits are on the left, requalifiers' are on the right.

Figure D11. 1997-2013/50K Option Permits.



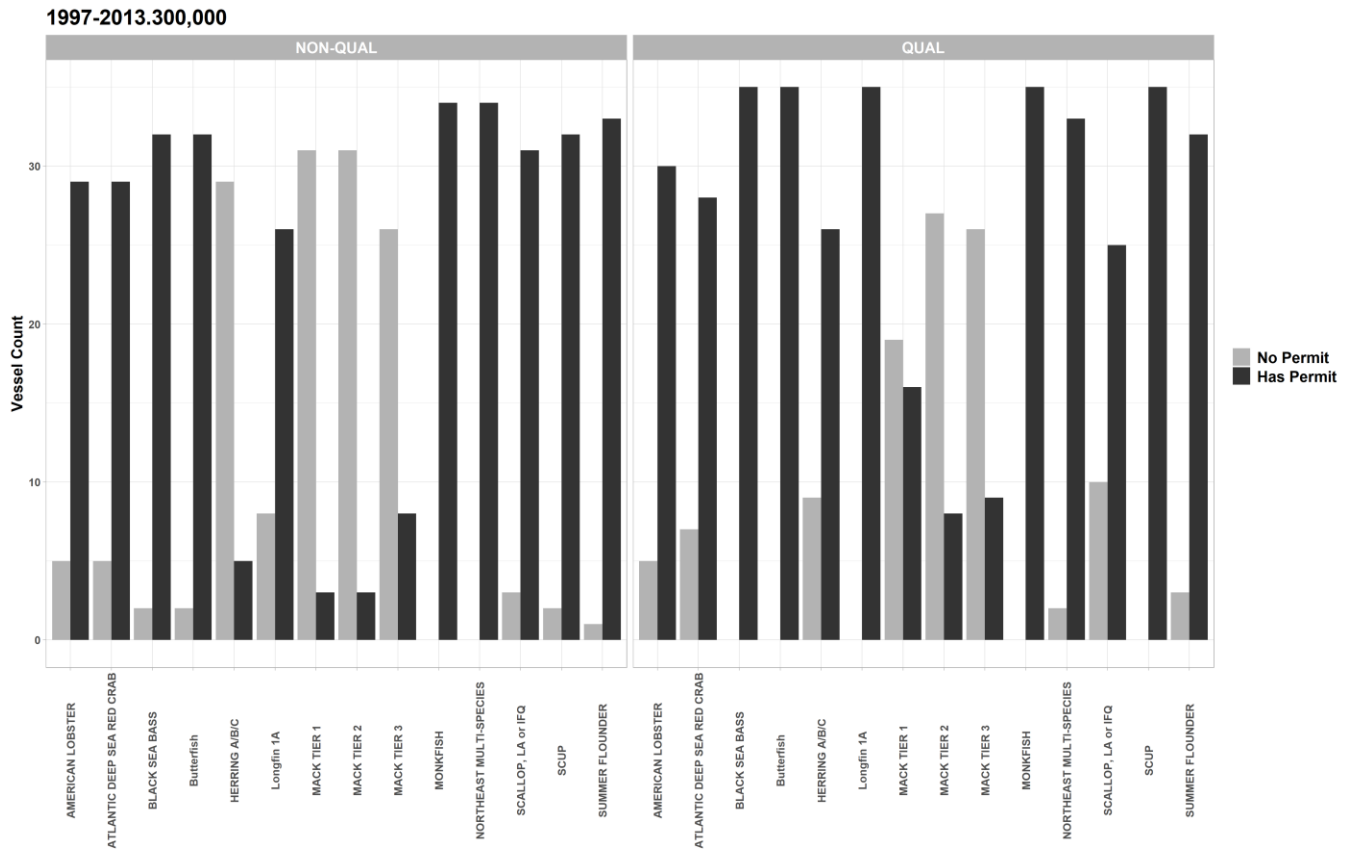
Non-requalifiers' current permits are on the left, requalifiers' are on the right.

Figure D12. 1997-2013/100K Option Permits.



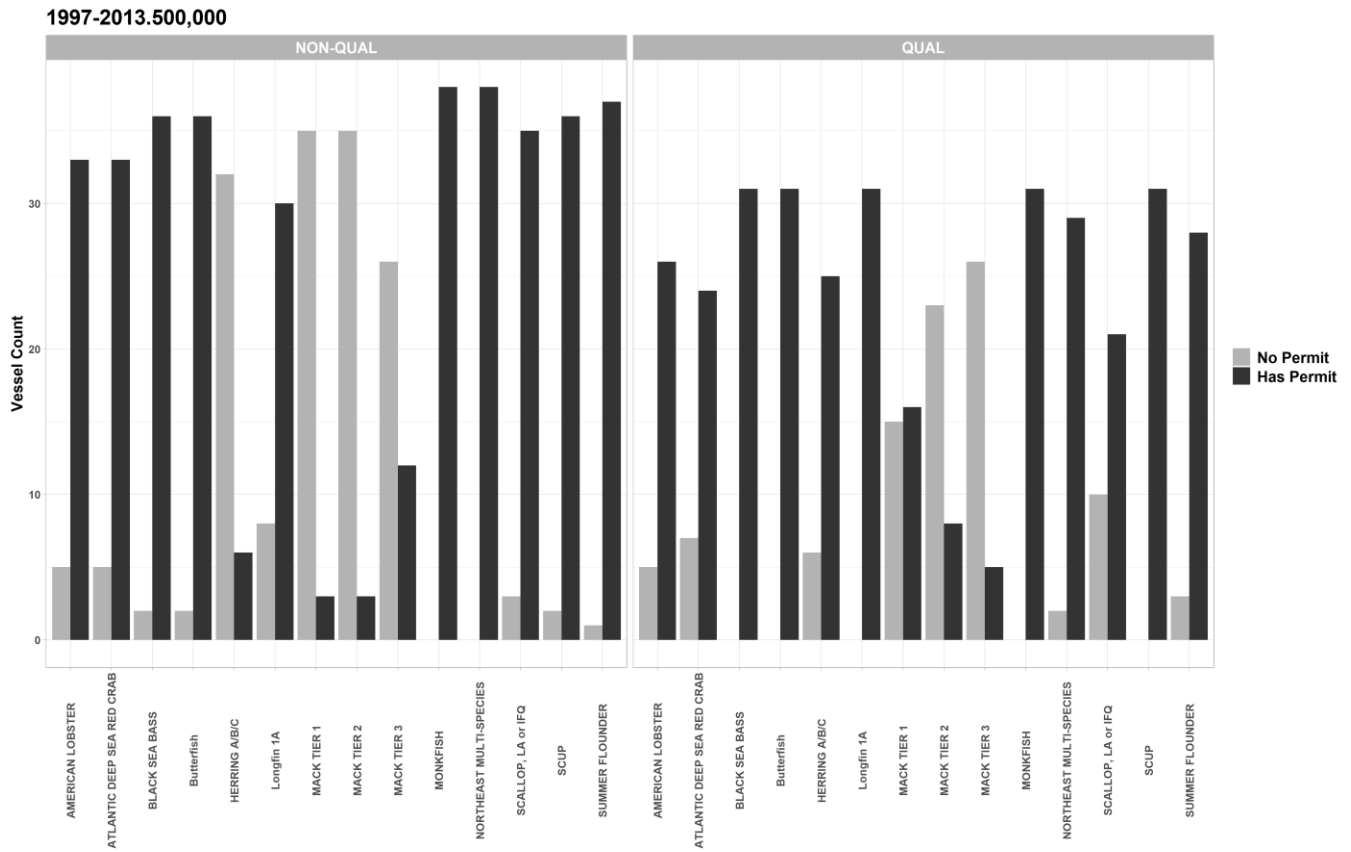
Non-requalifiers' current permits are on the left, requalifiers' are on the right.

Figure D13. 1997-2013/300K Option Permits.



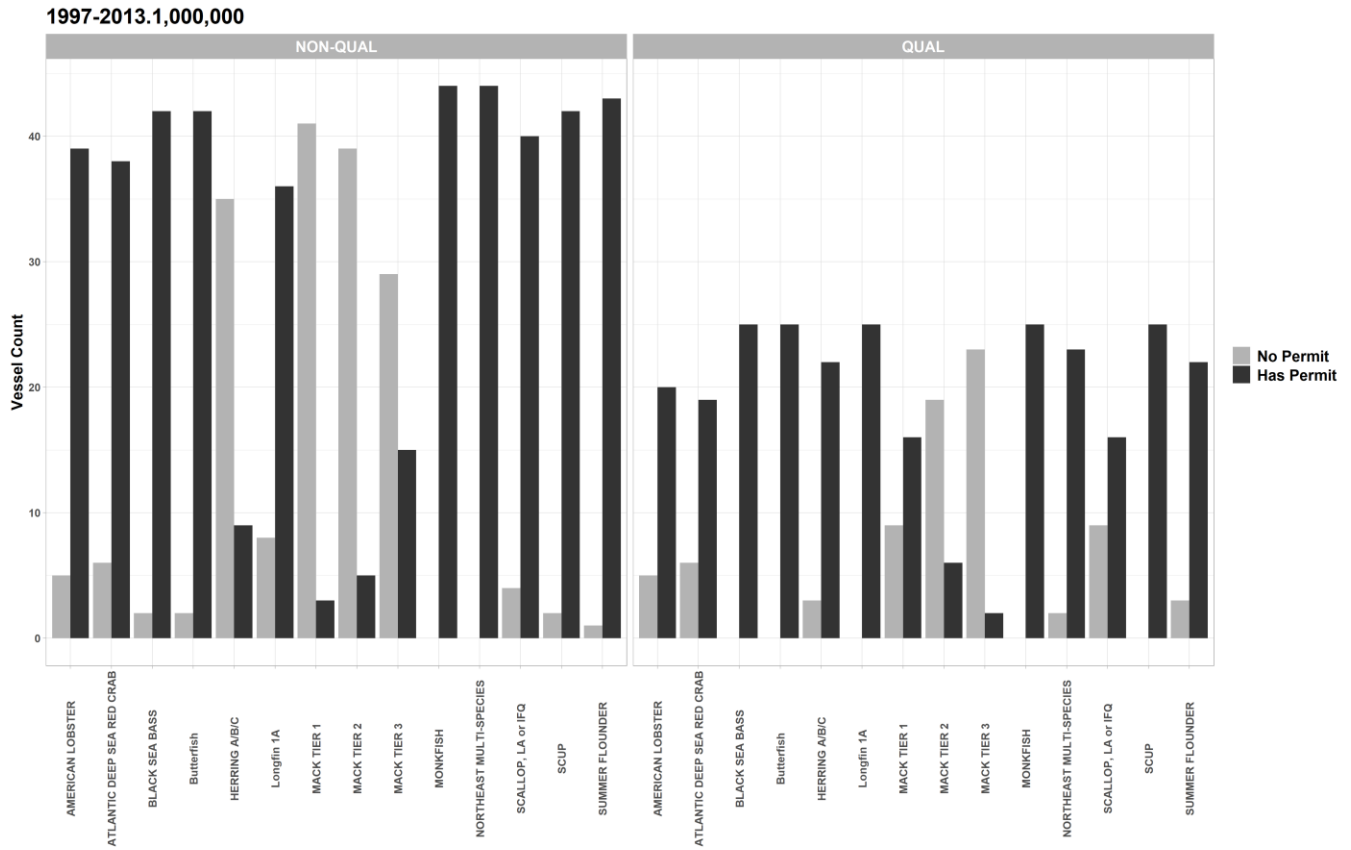
Non-requalifiers' current permits are on the left, requalifiers' are on the right.

Figure D14. 1997-2013/500K Option Permits.



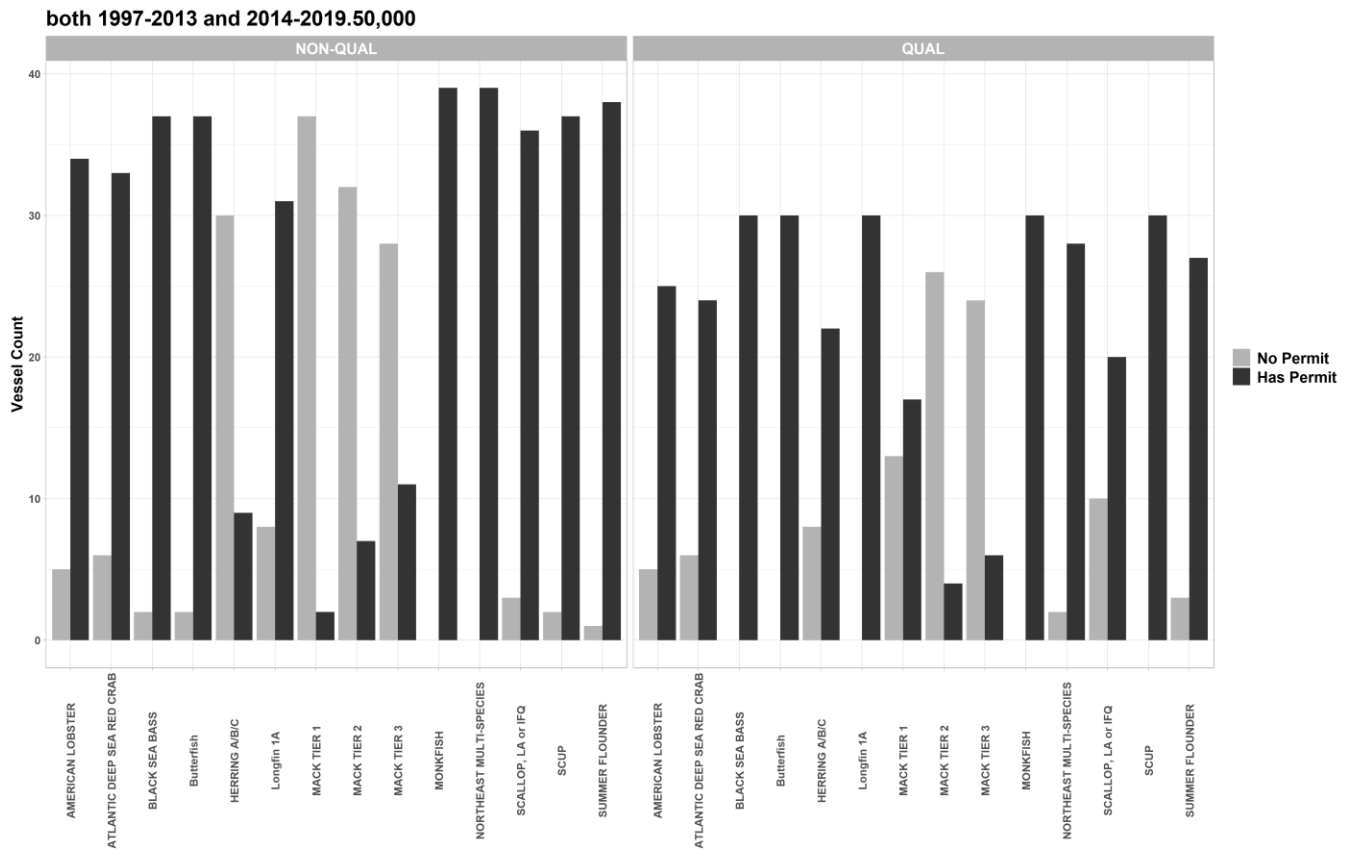
Non-requalifiers' current permits are on the left, requalifiers' are on the right.

Figure D15. 1997-2013/1,000,000 Option Permits.



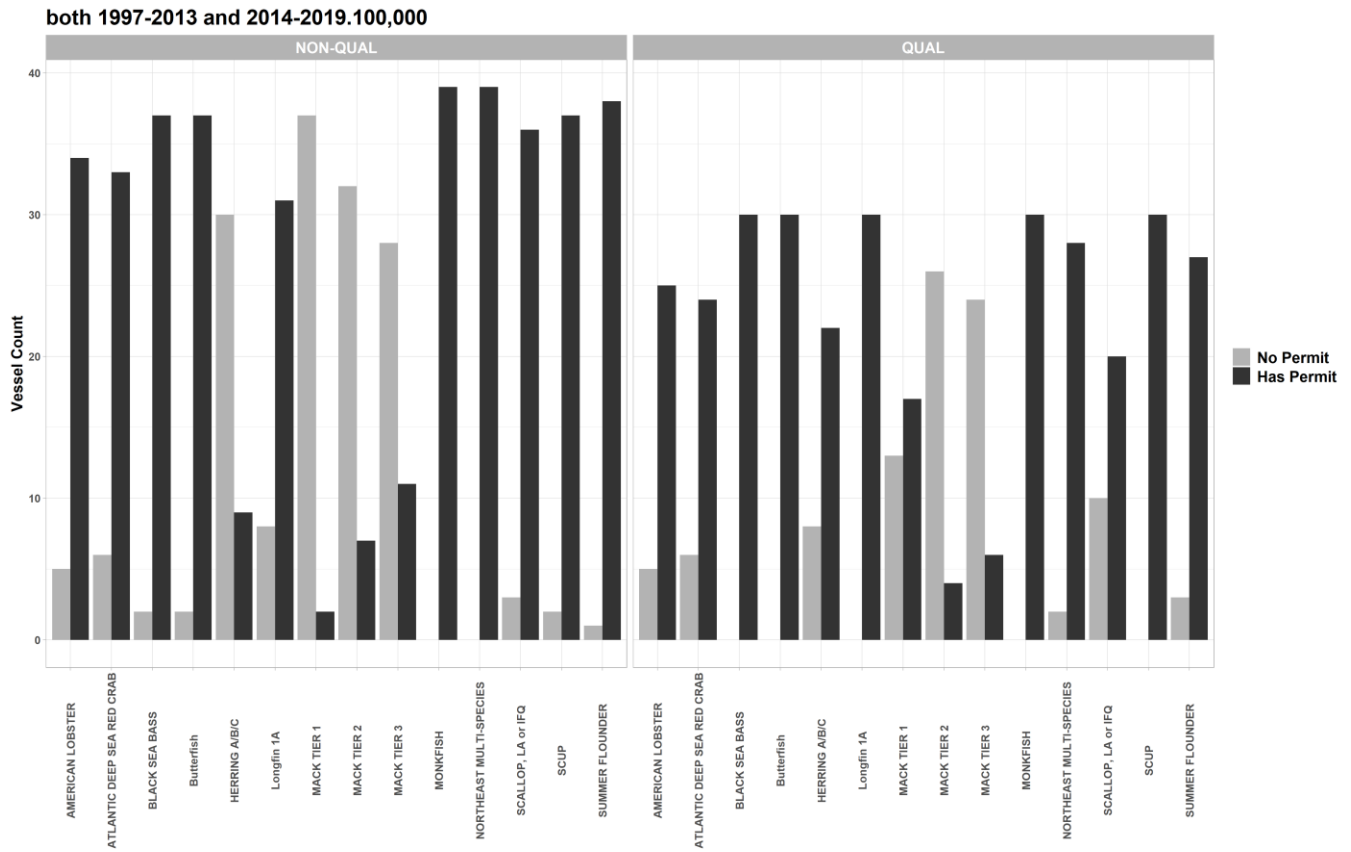
Non-qualifiers' current permits are on the left, qualifiers' are on the right.

Figure D16. 1997-2013 plus 2014-2019/50K Option Permits



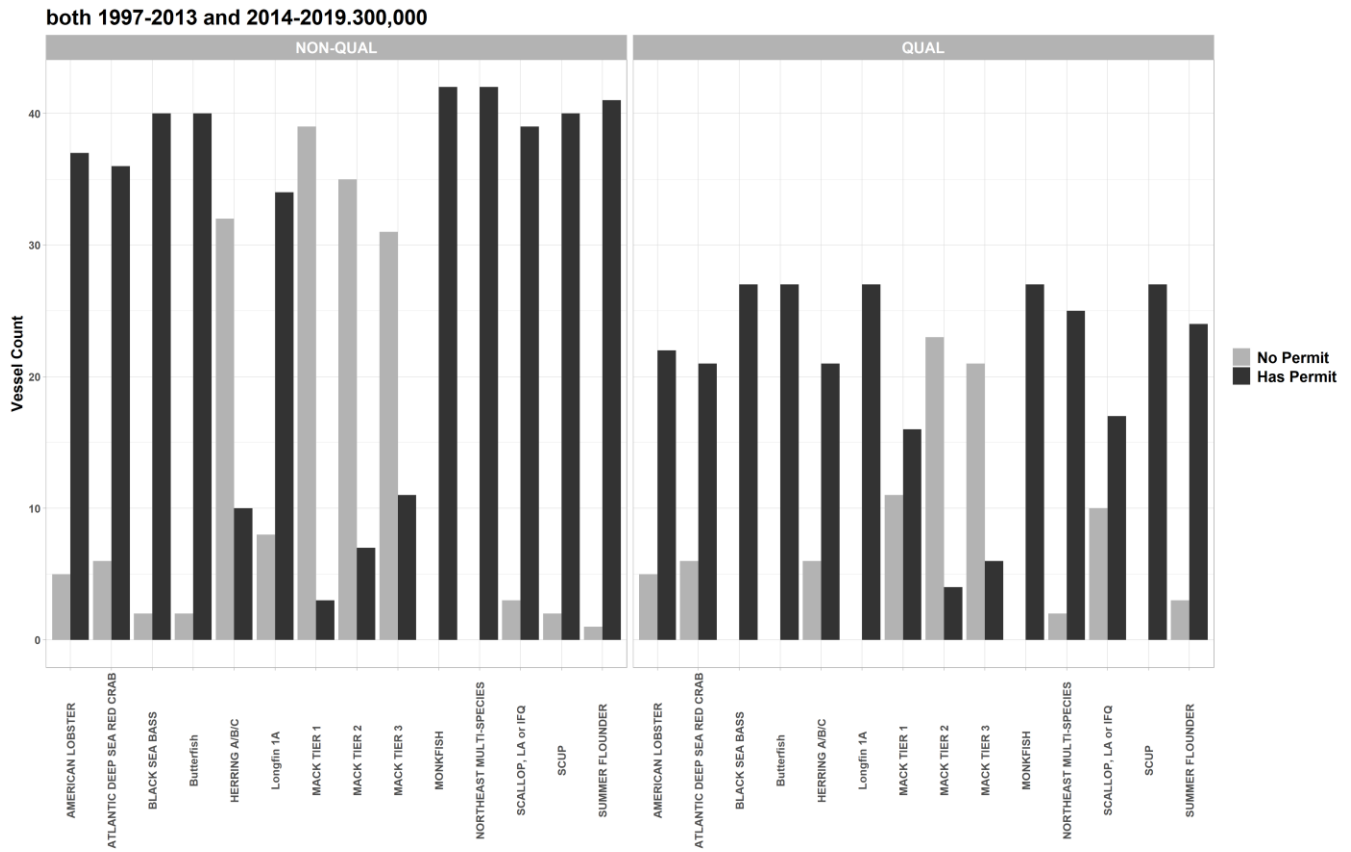
Non-requalifiers' current permits are on the left, requalifiers' are on the right.

Figure D17. 1997-2013 plus 2014-2019/100K Option Permits



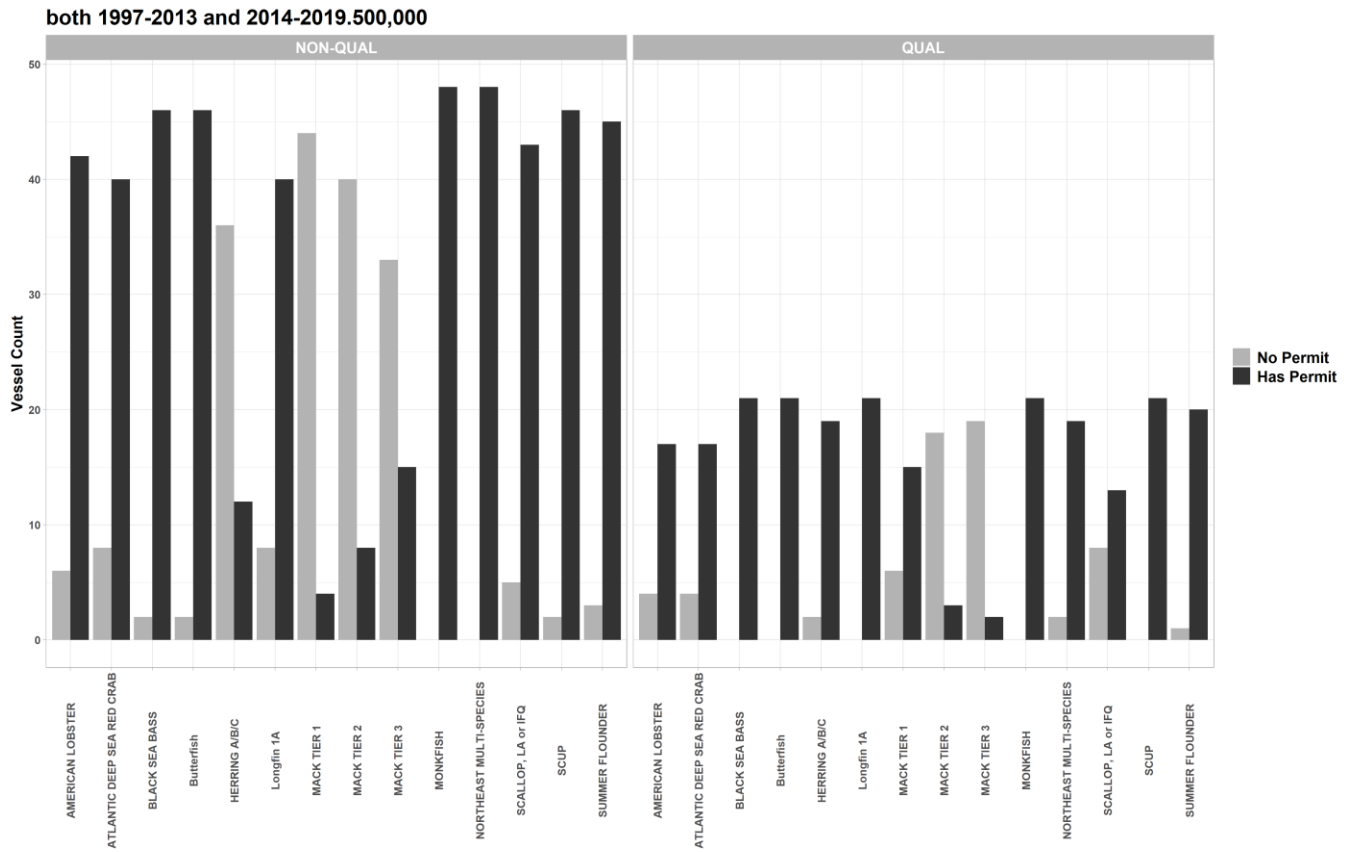
Non-requalifiers' current permits are on the left, requalifiers' are on the right.

Figure D18. 1997-2013 plus 2014-2019/300K Option Permits



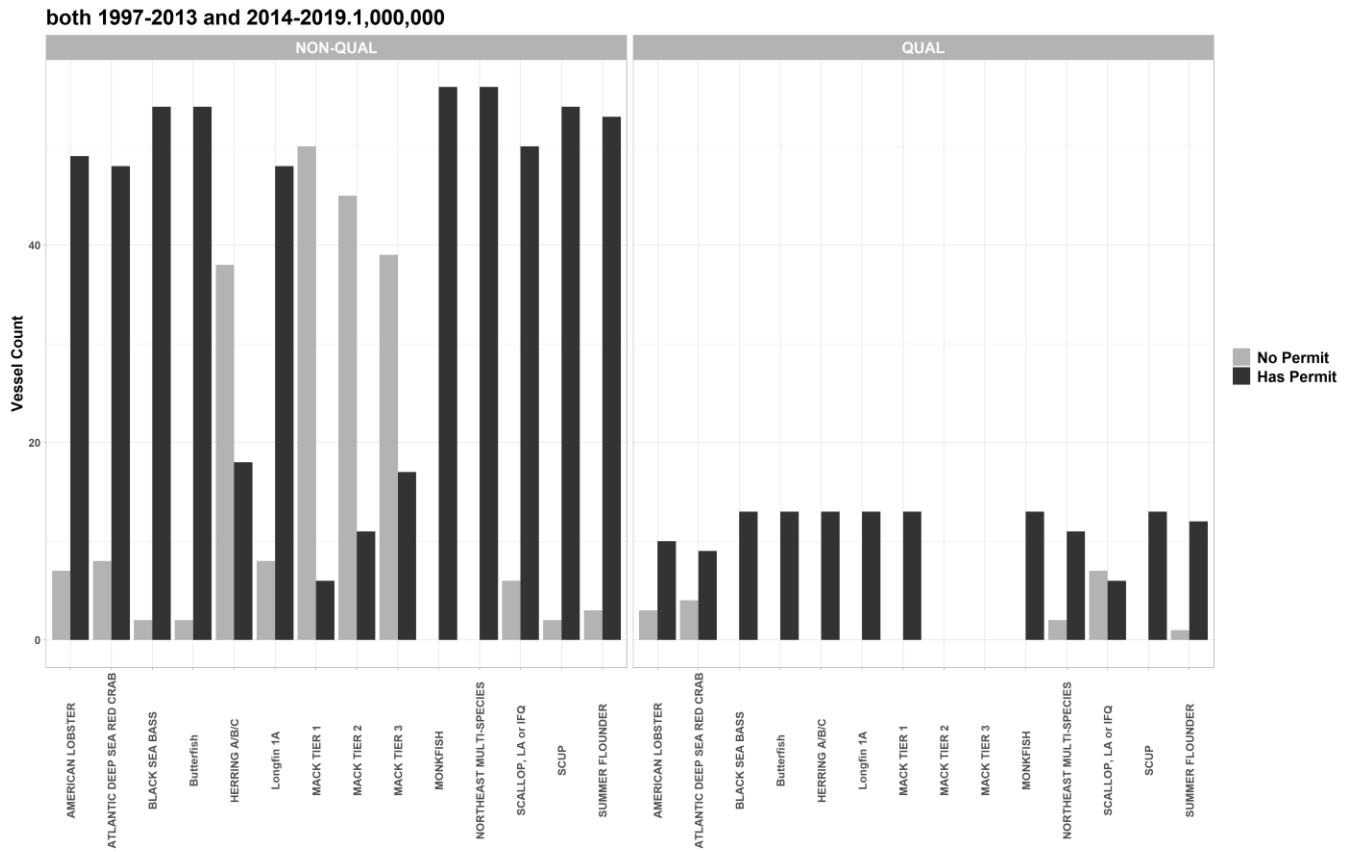
Non-requalifiers' current permits are on the left, requalifiers' are on the right.

Figure D19. 1997-2013 plus 2014-2019/500K Option Permits



Non-requalifiers' current permits are on the left, requalifiers' are on the right.

Figure D20. 1997-2013 plus 2014-2019/1,000,000 Option Permits



Non-requalifiers' current permits are on the left, requalifiers' are on the right.