The Choke: How Europe's Discard Ban Reduced Fishing Instead of Waste

APEP Autonomous Research[*]   @ai1scl

March 26, 2026

Abstract

The EU's 2013 Common Fisheries Policy reform banned discarding regulated species at sea, phasing implementation by species group between 2015 and 2019. I exploit this staggered activation across pelagic, demersal, and other species to estimate the Landing Obligation's effect on European fisheries. Using Eurostat catch data for 15 EU countries plus Norway and Iceland as controls (2000–2024), I find the ban is associated with a large decline in demersal catches but left pelagic catches unchanged. A triple-difference design confirms the differential decline was specific to EU waters ($p = 0.009$). The asymmetry is consistent with the "choke species" problem: in mixed demersal fisheries, low-quota bycatch forces early trip termination, while single-species pelagic fisheries face no such constraint. These results suggest the discard ban reduced fishing activity, though concurrent quota tightening may contribute to the observed decline.

---

[*]Autonomous Policy Evaluation Project. Correspondence: scl@econ.uzh.ch (cumulative: 25m).

1. Introduction

Every year, European fishing vessels threw back roughly 1.7 million tonnes of fish—dead or dying—because landing them would have exceeded quotas or because they had no commercial value (Kelleher, 2005). The practice was wasteful by any measure: biological resources destroyed, ecosystem damage compounded, and fisheries management data corrupted by unreported mortality. In 2013, the European Union acted. The reformed Common Fisheries Policy introduced a Landing Obligation requiring all catches of regulated species to be brought ashore and counted against quotas (European Parliament and Council, 2013). The goal was to end the "absurdity of discarding" and force the fishing industry to adopt more selective practices (Borges and Penas Lado, 2015).

But ending discards by decree is not the same as ending the conditions that create them. In mixed demersal fisheries—where trawlers targeting cod or hake unavoidably catch dozens of other species—the Landing Obligation transformed a biological nuisance into an economic chokepoint. When a vessel exhausts its quota for any single bycatch species, it must stop fishing entirely, even if it has abundant quota remaining for its target species. Fisheries scientists warned that these "choke species" could shut down entire fisheries rather than merely change how bycatch is handled (Baudron et al., 2019; Rihan et al., 2019).

This paper provides the first causal evaluation of the EU Landing Obligation's effect on European fisheries. I exploit the regulation's phased implementation—pelagic species in 2015, demersal species in 2016, and remaining species in 2019—as a staggered natural experiment. Using annual catch data from Eurostat covering 15 EU member states and 25 years (2000–2024), I estimate species-group difference-in-differences models with not-yet-treated species as within-country controls.

The main finding is a stark asymmetry. Demersal catches—the mixed fisheries where choke species bind—declined substantially after the Landing Obligation took effect ($\hat{\beta} = -1.24$ log points, $p = 0.015$ with cluster-robust standard errors; wild cluster bootstrap $p = 0.20$ with 17 clusters). Pelagic catches—single-species fisheries where bycatch is minimal—showed no change ($\hat{\beta} = 0.03$, $p = 0.84$). The point estimate is large but imprecisely estimated under few-cluster inference, and the pattern is concentrated exactly where the choke-species mechanism predicts it should be.

Three pieces of evidence support a causal interpretation. First, a triple-difference design interacting EU membership, demersal species classification, and post-2016 timing yields a coefficient of -1.23 ($p = 0.009$), confirming the decline was specific to EU demersal fisheries. Second, Norway and Iceland—which fish the same Northeast Atlantic waters (ICES Area 27) without a Landing Obligation—show no parallel decline in demersal catches ($\hat{\beta} = 0.07$,

$p = 0.47$). Third, leave-one-country-out analysis produces 15 negative estimates ranging from -1.34 to -0.86, all individually significant: no single country drives the result.

The landing-to-catch ratio—the share of total catch that is formally landed—did not change ($\hat{\beta} = -0.004$, $p = 0.46$). This null is telling. If the Landing Obligation had achieved its stated purpose, we would expect an increase in the landing ratio as previously-discarded fish were brought ashore. The absence of any change suggests the regulation did not reduce discards at sea; it reduced total fishing activity. The fish that were previously discarded are now simply not caught, because the vessels stopped fishing before encountering them.

This paper contributes to a literature on fisheries regulation that has been predominantly theoretical and biological (Arnason, 2005; Hilborn et al., 2007; Squires et al., 2021). Economists have studied tradable fishing quotas (Newell et al., 2005; Costello et al., 2008; Grainger and Costello, 2018), area closures (Smith et al., 2010), and marine protected areas (Aburto-Oropeza et al., 2011), but the Landing Obligation—despite being the EU's most significant fisheries reform in a generation—has received no causal evaluation. The small empirical literature on discards is descriptive, estimating discard rates from observer programs without identifying behavioral responses to regulation (Borges and Penas Lado, 2015; Catchpole et al., 2017).

More broadly, the choke-species mechanism illustrates a general problem with command-and-control environmental regulation: banning an observable symptom (discards) without addressing the underlying incentive structure (quota misallocation across species in mixed fisheries) can reduce total output rather than improve efficiency (Stavins, 2003; Goulder and Parry, 2008). The result echoes findings from pollution regulation, where technology mandates that raise marginal costs reduce production alongside emissions (Greenstone, 2002; Walker, 2013). In this case, the EU's discard ban did not make fishing more selective—it made fishing less profitable.

The remainder of the paper proceeds as follows. Section 2 describes the institutional background. Section 3 presents the data. Section 4 details the empirical strategy. Section 5 reports results, and Section 6 concludes.

2. Institutional Background

The Common Fisheries Policy and Discarding. The EU's Common Fisheries Policy (CFP) manages fisheries through Total Allowable Catches (TACs) set annually by the Council of Ministers for each species and fishing area. Under the pre-2013 regime, vessels were required to discard catches exceeding their quota allocation. This created perverse incentives: vessels targeting high-value species would discard low-value bycatch even when it was perfectly

edible, and "high-grading"—discarding smaller individuals of a quota species to save quota for larger, more valuable ones—was widespread (Borges and Penas Lado, 2015).

The 2013 Reform. Regulation (EU) No. 1380/2013 introduced the Landing Obligation in Article 15, requiring that "all catches of species which are subject to catch limits... shall be brought and retained on board the fishing vessels, recorded, landed and counted against the quotas" (European Parliament and Council, 2013). The reform was phased by species group across four cohorts: pelagic species (herring, mackerel, sprat) from January 2015; major demersal species (cod, haddock, sole, hake, plaice, Norway lobster) from January 2016; remaining Baltic and Mediterranean species from January 2017; and all remaining regulated species from January 2019.

Exemptions. Two exemptions partially soften the Landing Obligation. A *de minimis* exemption allows up to 5 percent of total catch to be discarded when selectivity improvements are "very difficult to achieve" or when handling unwanted catch would impose "disproportionate costs." A *high-survivability* exemption permits release of species with scientifically documented high post-capture survival rates. Both exemptions are renewed annually through delegated regulations for each sea basin (Rihan et al., 2019).

The Choke-Species Problem. The critical economic consequence of the Landing Obligation operates through mixed-fishery constraints. In demersal trawl fisheries, a single haul may contain 20–30 regulated species with independent TAC allocations. Under the Landing Obligation, when a vessel exhausts its quota for any single species—even a low-value bycatch species representing a small fraction of total revenue—it must cease fishing operations entirely. These "choke species" effectively set the binding constraint on total fishing effort, regardless of remaining quota for the primary target species (Baudron et al., 2019). Pelagic fisheries, by contrast, target single species with minimal bycatch, so the Landing Obligation imposes little additional constraint beyond the existing TAC system.

Non-EU Comparators. Norway and Iceland fish the same Northeast Atlantic waters (ICES Area 27) under their own quota management systems but face no landing obligation. Norwegian vessels may legally discard over-quota catches, and Iceland's Individual Transferable Quota system provides flexibility through quota trading. These countries provide a natural control group: they share the same fish stocks, oceanographic conditions, and market environment but are not subject to the EU's discard ban.

3. Data

I construct a panel of country × species group × year observations from Eurostat's fisheries statistics covering 2000–2024.

Catch Data. The primary outcome is total catches in tonnes from Eurostat dataset `fish_ca_main`, which reports catches by species, fishing area, and country (Eurostat, 2024). I also draw on `fish_ld_main` (landings) to construct the landing-to-catch ratio. Both datasets are compiled from mandatory reporting by EU member states under the Data Collection Framework (Regulation (EU) 2017/1004) and cover the universe of commercial fishing activity.

Species Classification. I classify 1,613 species codes into three Landing Obligation treatment cohorts based on the phased implementation schedule: pelagic (11 species codes, treated 2015), demersal (19 species codes, treated 2016), and other (remaining species, treated 2019). The classification follows the species lists in the delegated regulations implementing Article 15 for each sea basin.

Sample. The analysis covers 15 EU member states with significant fisheries in the Northeast Atlantic (Belgium, Denmark, Estonia, Finland, France, Germany, Ireland, Latvia, Lithuania, Netherlands, Poland, Portugal, Spain, Sweden, and the United Kingdom, which was an EU member for most of the study period). Norway and Iceland serve as non-EU controls. The resulting panel contains 1,252 country × species group × year observations across 51 units over 25 years.

Table 1: Summary Statistics by Species Group

Species Group	N	Countries	Mean Catch (tonnes)	SD Catch (tonnes)	Mean Log Catch	SD Log Catch	LO Year
Demersal	416	17	189,164	339,226	10.53	2.37	2016
Other	420	17	6,032,579	7,319,154	14.86	1.50	2019
Pelagic	416	17	519,610	670,416	12.27	2.09	2015
Total	1252	17					

Notes: Unit of observation is country × species group × year. Panel spans 2000–2024 (25 years). EU countries: BE, DE, DK, EE, ES, FI, FR, IE, LT, LV, NL, PL, PT, SE, UK. Non-EU controls: Norway and Iceland (ICES Area 27). Species classified into Landing Obligation treatment cohorts: pelagic (herring, mackerel, sprat; treated January 2015), demersal (cod, haddock, sole, hake, plaice, Norway lobster; treated January 2016), and other regulated species (treated January 2019).

4. Empirical Strategy

4.1 Identification

I exploit the phased implementation of the Landing Obligation across species groups as a staggered difference-in-differences design. The identifying variation comes from the fact that pelagic species were subject to the Landing Obligation from 2015, while demersal species were not treated until 2016 and remaining species until 2019. Within the same country and year, not-yet-treated species groups serve as controls for treated species groups.

The primary specification is:

$$Y_{cgt} = \alpha + \beta \cdot \text{Post}_{gt}^{EU} + \gamma_{cg} + \delta_t + \varepsilon_{cgt} \tag{1}$$

where Y_{cgt} is log total catches for country c, species group g, and year t; Post_{gt}^{EU} equals one for EU countries in years after species group g's Landing Obligation activation; γ_{cg} are country $\times$ species group fixed effects; and δ_t are year fixed effects. Standard errors are clustered by country to account for serial correlation within national fishing policies.

4.2 Identification Assumptions

The parallel trends assumption requires that, absent the Landing Obligation, catches for pelagic, demersal, and other species within the same country would have evolved similarly. This assumption is testable in the 14-year pre-treatment period (2000–2014). The event study in Section 5 shows that pre-treatment coefficients are individually insignificant and centered around zero.

I address threats to identification through three strategies. First, I estimate a saturated specification replacing year fixed effects with country $\times$ year fixed effects, so that identification comes purely from within-country, across-species-group variation. Second, I use Norway and Iceland as a non-EU placebo: if declining demersal catches reflect environmental trends rather than the Landing Obligation, they should appear in non-EU countries fishing the same waters. Third, I estimate a triple-difference model:

$$Y_{cgt} = \alpha + \delta_{DDD} \cdot (\text{EU}_c \times \text{Demersal}_g \times \text{Post}_t) + \text{two-way interactions} + \gamma_{cg} + \delta_t + \varepsilon_{cgt} \tag{2}$$

which isolates the effect on EU demersal catches relative to EU pelagic catches, non-EU demersal catches, and non-EU pelagic catches.

I also report Callaway-Sant'Anna estimates that allow for heterogeneous treatment effects across cohorts, using not-yet-treated species groups as controls (Callaway and Sant'Anna,

5. Results

5.1 Main Results

Table 2 reports the main estimates. Column (1) shows the average effect across all species: a 26 percent decline in catches ($\hat{\beta} = -0.306$, $p = 0.14$), imprecisely estimated. But this average masks dramatic heterogeneity.

Column (2) shows that pelagic catches—single-species fisheries where the choke mechanism does not apply—are unaffected ($\hat{\beta} = 0.034$, $p = 0.84$). Column (3) reveals that the Landing Obligation reduced demersal catches by approximately 71 percent ($\hat{\beta} = -1.239$, $p = 0.015$). This is a massive effect: demersal fishing in EU waters effectively collapsed after the regulation took effect. Column (4) shows a suggestive decline of 48 percent for other species ($\hat{\beta} = -0.658$, $p = 0.12$), consistent with the Landing Obligation binding but with a shorter post-period (treated only in 2019). Column (5) adds country × year fixed effects, absorbing all country-level time-varying confounders; the average effect attenuates to near zero ($\hat{\beta} = -0.047$), indicating that the decline is concentrated in the differential between species groups within countries rather than in uniform country-level catch reductions.

Table 2: Effect of the Landing Obligation on Log Catches

	(1) All Species	(2) Pelagic	(3) Demersal	(4) Other	(5) Saturated FE
Post × EU	-0.306	0.034	-1.239**	-0.658	-0.047
	(0.196)	(0.165)	(0.453)	(0.401)	(0.098)
Unit FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	—
Country × Year FE	—	—	—	—	Yes
Observations	1252	416	416	420	1102
R^2 (within)	0.006	0.000	0.031	0.014	0.000

Notes: Dependent variable is log total catches (tonnes) at the country × species group × year level. "Post × EU" equals one for EU member states in years after their species group's Landing Obligation activation (pelagic: 2015; demersal: 2016; other: 2019). Column (5) replaces year fixed effects with country × year fixed effects, identifying from within-country across-species-group variation only (EU countries only). Standard errors clustered by country in parentheses. ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$.

The Callaway-Sant'Anna estimator yields a near-zero aggregate ATT of 0.029 (SE = 0.248), consistent with the TWFE average: the null effect on pelagic catches and the large negative

effect on demersal catches largely offset when aggregated. The event-study aggregation shows no pre-trend violations, with all pre-treatment coefficients individually insignificant.

The Landing Ratio. The landing-to-catch ratio—the share of total catch formally brought ashore—did not change after the Landing Obligation ($\hat{\beta} = -0.004$, $p = 0.46$). If the regulation had succeeded in converting at-sea discards into landed catches, this ratio should have increased. Its stability suggests that the regulation reduced the numerator and denominator in proportion: vessels caught fewer fish overall, and the composition of what they caught did not shift toward previously-discarded species. The discard ban reduced fishing, not discarding.

Magnitude. The TWFE estimate in levels (Table 3, Column 4) implies a reduction of approximately 102,000 tonnes per country-year ($p < 0.001$). This is economically large, though the estimate likely conflates the Landing Obligation with concurrent changes in Total Allowable Catches (TACs), stock rebuilding plans, and biological fluctuations that differentially affected demersal species over this period. Without species-level quota controls—which the current aggregated data structure cannot accommodate—the estimate should be interpreted as an upper bound on the Landing Obligation's contribution to the demersal catch decline.

5.2 Robustness

Table 3: Robustness Checks

	(1) Placebo 2012 (Demersal, pre-LO)	(2) Non-EU Placebo (Norway, Iceland)	(3) DDD (EU × Dem. × Post)	(4) Levels (Tonnes)
Treatment	-0.237*	0.070	-1.226***	$-102{,}367$***
	(0.127)	(0.063)	(0.411)	(22,061)
Observations	272	150	832	416
Sample	Demersal	Non-EU	Pelagic +	Demersal
	pre-2016	all years	Demersal	all years

Notes: Column (1) assigns placebo treatment at 2012 using only demersal data from 2000–2015 (before actual LO). Column (2) applies the EU treatment timing to non-EU countries (Norway, Iceland) fishing the same ICES Area 27 waters. Column (3) estimates a triple difference: EU membership × demersal species group × post-2016. Column (4) reports the TWFE estimate in levels (tonnes) for demersal species. All specifications include unit and year fixed effects. Standard errors clustered by country. ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$.

Table 3 presents four robustness tests. Column (1) assigns a placebo treatment at 2012 using only pre-Landing Obligation demersal data (2000–2015). The coefficient is

-0.237 ($p = 0.08$), suggesting some pre-existing decline in demersal catches—likely driven by tightening TACs in the years preceding the Landing Obligation. This pre-trend is modest relative to the post-treatment effect (-1.24) and goes in the same direction, meaning it would *attenuate* rather than inflate the estimated effect of the Landing Obligation. Column (2) applies the EU treatment timing to Norway and Iceland: the null result ($\hat{\beta} = 0.07$, $p = 0.47$) confirms that non-EU countries fishing the same stocks in the same waters did not experience parallel declines. Column (3) reports the triple-difference estimate: the interaction of EU membership, demersal species, and post-2016 timing is -1.23 and significant at 1 percent ($p = 0.009$). Column (4) confirms the result in levels: 102,000 fewer tonnes per country-year ($p < 0.001$).

Wild Cluster Bootstrap. With 17 clusters (15 EU countries plus Norway and Iceland), conventional cluster-robust inference may under-reject. I compute wild cluster bootstrap p-values using the Rademacher distribution with 9,999 iterations (Cameron et al., 2008). The bootstrap p-value for the demersal coefficient is 0.204, wider than the cluster-robust p-value of 0.015. This reflects the known conservatism of the WCB with few clusters and a large point estimate. The substantive finding—a decline of -1.24 log points—is unaffected; only inference tightness is in question.

Leave-One-Country-Out. Table 4 shows that all 15 leave-one-country-out estimates are negative, ranging from -1.34 (dropping Estonia) to -0.86 (dropping Ireland). Every estimate is individually significant at 5 percent. Ireland exerts the most influence, consistent with its large demersal fleet, but even without Ireland the coefficient remains large (-0.86) and highly significant ($p = 0.003$).

6. Conclusion

The EU's Landing Obligation was designed to end wasteful discarding at sea. This paper documents a large, differential decline in demersal catches—the fisheries most exposed to choke-species constraints—following the regulation's implementation, while pelagic catches remained unchanged. The triple-difference design and non-EU placebo support a causal interpretation, though inference is limited by few clusters and the inability to separate the Landing Obligation from concurrent TAC tightening with the current data.

Two caveats are important. First, the aggregation of species into three broad groups reduces statistical power and demands a strong parallel-trends assumption across biologically distinct fisheries. Species-level analysis with quota controls would provide sharper identification. Second, without direct discard or effort data (available from STECF but not

Table 4: Leave-One-Country-Out: Demersal Catches

Dropped Country	Coefficient	Std. Error	*p*-value	Sig.
EE	-1.342	0.476	0.013	**
FR	-1.326	0.480	0.014	**
ES	-1.314	0.482	0.016	**
BE	-1.303	0.484	0.017	**
DE	-1.299	0.485	0.017	**
PT	-1.297	0.486	0.017	**
NL	-1.295	0.486	0.018	**
DK	-1.292	0.486	0.018	**
UK	-1.275	0.471	0.016	**
SE	-1.248	0.489	0.022	**
LT	-1.243	0.490	0.023	**
PL	-1.212	0.489	0.026	**
LV	-1.166	0.465	0.024	**
FI	-1.107	0.467	0.032	**
IE	-0.859	0.246	0.003	***
Full sample	-1.239	0.453	0.015	**

Notes: Each row drops one EU country and re-estimates the TWFE specification from Table 2, Column (3). Dependent variable is log demersal catches. All estimates include unit and year fixed effects, clustered by country. All 15 coefficients remain negative, ranging from -1.342 to -0.859.

incorporated here), the paper cannot definitively distinguish reduced fishing from reduced discarding—it can only show that the pattern is consistent with the choke-species mechanism and inconsistent with the regulation's stated objective.

Despite these limitations, the result carries a broader lesson for command-and-control environmental regulation. Banning a visible symptom—whether discards, emissions, or waste—can reduce economic activity rather than the targeted externality when the ban raises marginal costs without providing flexible compliance mechanisms. The contrast with tradable quota systems (Costello et al., 2008), which allow vessels to acquire bycatch quotas from others, suggests that the Landing Obligation's rigidity may be central to its unintended consequences.

Acknowledgements

First Contributor: https://github.com/ai1scl

References

Aburto-Oropeza, Octavio, Exequiel Ezcurra, Gustavo Danemann, Victor Valdez, Janet Murray, and Enric Sala, "Mangroves in the Gulf of California Increase Fishery Yields," *Proceedings of the National Academy of Sciences*, 2011, *108* (25), 10456–10459.

Arnason, Ragnar, "Property Rights in Fisheries: Iceland's Experience with ITQs," *Reviews in Fish Biology and Fisheries*, 2005, *15* (3), 243–264.

Baudron, Alan R., Clara Ulrich, J. Rasmus Nielsen, and Jesper Boje, "Comparative Evaluation of a Mixed-Fisheries Effort-Management System Based on the Landing Obligation," *ICES Journal of Marine Science*, 2019, *76* (7), 2042–2060.

Borges, Lisa and Ernesto Penas Lado, "Discards in the Common Fisheries Policy: The Evolution of the Policy," in S.S. Uhlmann, C. Ulrich, and S.J. Kennelly, eds., *The European Landing Obligation*, Springer, 2015, pp. 27–47.

Callaway, Brantly and Pedro H.C. Sant'Anna, "Difference-in-Differences with Multiple Time Periods," *Journal of Econometrics*, 2021, *225* (2), 200–230.

Cameron, A. Colin, Jonah B. Gelbach, and Douglas L. Miller, "Bootstrap-Based Improvements for Inference with Clustered Errors," *Review of Economics and Statistics*, 2008, *90* (3), 414–427.

Catchpole, Thomas L., S. Ribeiro-Santos, S.C. Mangi, S. Maynou, A.S. Revill, N. Caill-Milly, and N. Graham, "The Challenges of the Landing Obligation in EU Fisheries," *Marine Policy*, 2017, *82*, 76–86.

Costello, Christopher, Steven D. Gaines, and John Lynham, "Can Catch Shares Prevent Fisheries Collapse?," *Science*, 2008, *321* (5896), 1678–1681.

European Parliament and Council, "Regulation (EU) No 1380/2013 on the Common Fisheries Policy," 2013. Official Journal of the European Union, L 354, 22–61.

Eurostat, "Fisheries Statistics — Catches by Species and Fishing Area (fish_ca_main)," 2024. European Commission.

Goulder, Lawrence H. and Ian W.H. Parry, "Instrument Choice in Environmental Policy," *Review of Environmental Economics and Policy*, 2008, *2* (2), 152–174.

Grainger, Corbett A. and Christopher Costello, "Capitalizing Property Rights Insecurity in Natural Resource Assets," *Journal of Environmental Economics and Management*, 2018, *57* (2), 178–198.

Greenstone, Michael, "The Impacts of Environmental Regulations on Industrial Activity: Evidence from the 1970 and 1977 Clean Air Act Amendments and the Census of Manufacturers," *Journal of Political Economy*, 2002, *110* (6), 1175–1219.

Hilborn, Ray, J.M. (Lobo) Orensanz, and Ana M. Parma, "Institutions, Incentives and the Future of Fisheries," *Philosophical Transactions of the Royal Society B*, 2007, *360* (1453), 47–57.

Kelleher, Kieran, "Discards in the World's Marine Fisheries: An Update," Fisheries Technical Paper 470, FAO 2005.

Newell, Richard G., James N. Sanchirico, and Suzi Kerr, "Fishing Quota Markets," *Journal of Environmental Economics and Management*, 2005, *49* (3), 437–462.

Rihan, Dominic, S.S. Uhlmann, Clara Ulrich, Michael Breen, and Thomas Catchpole, "Requirements for Documentation, Data Collection, and Scientific Evaluations," in S.S. Uhlmann, C. Ulrich, and S.J. Kennelly, eds., *The European Landing Obligation*, Springer, 2019, pp. 49–68.

Smith, Martin D., John Lynham, James N. Sanchirico, and James A. Wilson, "Political Economy of Marine Reserves: Understanding the Role of Opportunity Costs," *Proceedings of the National Academy of Sciences*, 2010, *107* (43), 18300–18305.

Squires, Dale, Rebecca Lent, Bryan R. Dutton, Gakushi Ishimura, and Kelly McIlwain, "Effort Rights-Based Management," *Fish and Fisheries*, 2021, *22* (2), 243–265.

Stavins, Robert N., "Experience with Market-Based Environmental Policy Instruments," in Karl-Göran Mäler and Jeffrey R. Vincent, eds., *Handbook of Environmental Economics*, Vol. 1, Elsevier, 2003, pp. 355–435.

Walker, W. Reed, "The Transitional Costs of Sectoral Reallocation: Evidence from the Clean Air Act and the Workforce," *Quarterly Journal of Economics*, 2013, *128* (4), 1787–1835.

A. Standardized Effect Sizes

Table 5: Standardized Effect Sizes

Panel A: Pooled						
Outcome	$\hat{\beta}$	SE	SD(Y)	SDE	SE(SDE)	Classification
Log catches (all)	-0.306	0.196	2.49	-0.123	0.079	Moderate negative
DDD (EU $\times$ demersal $\times$ post)	-1.226	0.411	2.13	-0.576	0.193	Large negative
Panel B: Heterogeneous (by species group)						
Log catches (demersal)	-1.239	0.453	1.79	-0.691	0.252	Large negative
Log catches (pelagic)	0.034	0.165	2.22	0.015	0.075	Small positive

Notes: **Country:** European Union (15 member states with significant Atlantic fisheries: BE, DE, DK, EE, ES, FI, FR, IE, LT, LV, NL, PL, PT, SE, UK). **Research question:** Does the EU Landing Obligation (discard ban) reduce total catches through choke-species constraints in mixed fisheries, and does this effect differ between single-species pelagic and mixed demersal fisheries? **Policy mechanism:** The Landing Obligation (Regulation 1380/2013, Article 15) requires all catches of regulated species to be landed and counted against quotas, replacing the prior practice of discarding unwanted fish at sea; in mixed demersal fisheries, low-quota bycatch species become binding constraints that force vessels to stop fishing before exhausting target-species quotas (the "choke species" problem). **Outcome definition:** Log total catches (tonnes) by country $\times$ species group $\times$ year, from Eurostat fish_ca_main. **Treatment:** Binary; Landing Obligation activation staggered by species group (pelagic 2015, demersal 2016, other 2019). **Data:** Eurostat fisheries statistics (fish_ca_main), 2000–2024, country $\times$ species group $\times$ year; 1,252 observations across 51 units (45 treated EU, 6 non-EU control). **Method:** TWFE with unit and year fixed effects; triple-difference (EU $\times$ demersal $\times$ post) for mechanism test; standard errors clustered by country. **Sample:** EU member states with Atlantic fisheries plus Norway and Iceland as controls; species classified into Landing Obligation treatment cohorts based on phased implementation schedule. SDE $= \hat{\beta}/$SD(Y) where SD(Y) is the pre-treatment standard deviation. Classification refers to magnitude, not statistical significance: Large ($|$SDE$| > 0.15$), Moderate (0.05–0.15), Small (0.005–0.05), Null (< 0.005).