Table 1a. Dredging effects reported from research studies on the northern quahog, *Mercenaria mercenaria*. N/A indicates no data.

Habitat Sediment	Harvest Gear	Study Location	Biological Effects	Physical Effects	Chemical Effects	Recovery	Author
Tidal river bottom	Hydraulic escalator dredge	Santee River, South Carolina	No harmful effects on biota, more live oysters found after harvest because of early spat settlement, fewer found where harvesters removed commercial sized animals	N/A	N/A	N/A	Burrell 1975a
Subtidal mixed sediment	Hydraulic escalator dredge	Santee River, South Carolina	Amount of spat in water column similar between harvested and unharvested areas	0.1 M tow depth	N/A	N/A	Burrell 1975b
Firm sandy mud	8 and 12-toothed clam dredges	Narragansett Bay, Rhode Island	1% gear-related breakage of commercial sized clams, low breakage or smothering of undersized clams, removed clams > 60 mm, decreased tube worms	Mixing of sandy-mud and clay layer more pronounced than in control area, sediment was also softer	N/A	N/A	Glude and Landers 1953
Mud and sand	Hydraulic escalator dredge	Rappahannock, James and York rivers, Virginia	Dredging did not increase hard or soft clam set, oysters 75-100 ft from dredged area were unaffected, dredging uprooted eelgrass and removed invertebrate tubes	Dredging changed appearance, composition and texture of seafloor, created trenches 6-8 inches deep, reduced silt-clay fraction, moved buried shell to surface, effects within 75 ft of dredge	N/A	Trenches refilled within 1-2 months	Haven 1979
Assorted sediments sand, silt, clay, $CaCO_3$,	Hydraulic escalator harvester	South Carolina Tidal creeks: Back Creek, Hamlin Creek, Summerhouse Creek, 2 creeks near Isle of Palms	After harvest polychaetes decreased, amphipods increased, diversity and abundance increased, no difference in mobile fish and invertebrates	Elevated turbidity in vicinity of harvest, plumes extended < 2 km, highest < 1 km away, several hours duration, increased $CaCO_3$ and decreased clay following harvest	N/A	N/A	Maier et al. 1998

Table 1a, continued. Dredging effects reported from research studies on the hard clam, *Mercenaria mercenaria*. N/A indicates no data.

SAV beds	Clam dredge	Chincoteague Bay, Virginia	SAV absent from dredge circles, vegetation was dense and healthy just outside of dredge zone	Dredging disrupted sediments from rich organic sand to coarse sand and broken shell	N/A	Predicted that recovery of SAV will exceed 5 yrs	Moore and Orth 1997
SAV beds	Clam dredge	Chincoteague Bay, Virginia	15% less vegetation than found at scar edge, low cover in scar area except at center	Increased bottom depth in scars, large holes up to 1 meter diameter and 30-40 cm deep	N/A	Rate of revegetation related to scar size, dredging intensity, and remaining vegetation; topography and sediment type may hinder rate of revegetation	Orth et al. 1998
Seagrass bed and sand flat	Clam “kicking” and raking	Back Sound, North Carolina	Raking and light clam kicking: seagrass declined 25% below controls; intense clam kicking: 65% decline, clam harvest had no effect on density or species composition, harvest did not boost clam recruitment	N/A	N/A	Raking/ light clam kicking: SAV recovery in 1yr, intense kicking: recovery in 2yrs, SAV remained 35% lower than control after 4-yrs	Peterson et al. 1987

Table 1b. Dredging effects reported from research studies on the softshell clam, *Mya arenaria*. N/A indicates no data.

Habitat-Sediment	Harvest Gear	Study Location	Biological Effects	Physical Effects	Chemical Effects	Recovery	Author
Intertidal flats	Hydraulic escalator dredge	Nova Scotia, Canada	Removed 90% of small clams and 50% of market sized, 1% shell breakage	Dug to 14 in depth, high efficiency	N/A	N/A	Dickie and MacPhail 1957
Mud and sand substrate	Hydraulic escalator dredge	Chesapeake Bay, Virginia	Dredging did not increase hard or soft-shell clam set, oysters 75-100 ft from dredged area unaffected	Seafloor appearance, composition, and texture altered; removed invertebrate tubes; trenches 6-8 in. deep, reduced silt-clay fraction; moved buried shell to surface; changes occurred within 75 ft of dredge	N/A	Trenches filled within 1-2 months	Haven 1979
Silt-clay intertidal flats	Hydraulic escalator dredge	Harraseeket River, Maine	Few significant changes: *Corophium volutator* declined, vegetation uprooted in tracks, clams intact and unbroken, decrease in large clams, decline in polychaetes, increase in *Macoma balthica*	Solid clay removed from flats creating a trench filled with soft sediments, turbidity briefly increased as a plume but suspended solids returned to low levels, created trenches 30-45 cm deep and mounds of spoils	Slight changes in chemical parameters, low DO and pH indicate reduced sediment brought up by dredge into water column, was quickly oxidized	Trenches hard and well defined for 2 months, spoil heaps lasted 2-3 months, at 10 months trenches had fine, soft sediment 5-8 cm below normal flat, major species increased by 10 months	Kyte et al. 1976
Muddy soil, sandy further toward beach	Hydraulic clam rake	Pottery Bridge Flat, St. Andrews, Canada	Harvested 60% commercial clams, no breakage of marketable clams with short nozzle, some mortality with long nozzle	Created a track that remained soft for a few days and was an inch or two lower than undisturbed flat	N/A	N/A	MacPhail 1961a

Table 1b, continued. Dredging effects reported from research studies on the soft-shell clam, *Mya arenaria*. N/A indicates no data.

Intertidal flats	Mechanical escalator dredge	Clam Harbour, Nova Scotia Canada	Initial tests dredge harvested 90% of small clams, 50% of commercial sized, some mortality of seed clams by smothering and overcrowding, after dredging little to no damage to shellfish	Dug deep trenches in shallow water	Only 7-10% were too damaged to rebury after 3 hours	N/A	MacPhail 1961b
Fine sand	Hydraulic clam rake	Clam Harbour, Nova Scotia Canada	Damage to <5% of marketable clams and <5% of small clams remaining after harvest, sand and grit in mantle cavity of clams, shell breakage <1%	Liquefied upper soil strata into soil-water suspension, tracks 24 inches wide, 2.5 in deep, poor operation can excavate wells in sediment	N/A	N/A	MacPhail and Medcof 1962
Oyster beds and clams on soft sediment	Hydraulic clam dredge	Maryland	Intensive dredging: mortality of oysters in dredge zone and 25 ft downstream, no mortality of oysters or spat 75 ft beyond dredge, few clams broken, increase in predatory fish and crabs, dredging not a hazard to tidewater resources away from oyster beds	Intensive dredging elevated turbidity and caused redeposition of suspended sediment 75 ft downstream, trenches up to 18 in deep but more typically 2-8 in	N/A	Trenches 4-6 days after dredging 3 inches deep, recovery variable, sediments may take months to compact, dredged areas continue to repopulate with clams	Manning 1957
Subtidal assorted sediments	Maryland soft shell clam dredge	Maryland	No damage to fish or blue crabs, about 1% breakage of collected clams, reduced number of market sized clams, some breakage of fragile animals in collection baskets at end of conveyer, fish attracted to dredge track due to food availability	Sediment dislodged from the bottom, and falls through the conveyer or brought to the surface	N/A	After 7 yrs of harvesting, no evidence of impaired reproduction or replacement of stocks	Manning 1960

Table 1b, continued. Dredging effects reported from research studies on the soft-shell clam, *Mya arenaria*. N/A indicates no data.

Clam flat, clean sandy soil	Hydraulic rake	Clam Harbour, Nova Scotia, Canada	Damage to <5% of the catch and <5% of the clams left behind	Upper substratum is converted to a soil-fluid mixture, track width measured 33 in, track was firm after 24 hours, nozzle settings determine track width	N/A	N/A	Medcof and MacPhail 1962
Intertidal beaches, sandy flats	Maryland style hydraulic escalator clam dredge	Clam Harbour, Nova Scotia, Canada	Clams returned after dredging settled on the surface, not buried or smothered, breakage to 7-10% of clams, 90% of small clams returned within 75-100 ft of where they entered the dredge, clams reburied quickly	Heavy "soil" settled first in tracks, tracks 50-75 in. wide with surfaces 4-6 inches below adjacent levels, crumbling and erosion of tracks with extended widths	N/A	N/A	Medcof 1961
Medium to fine sands	Maryland hydraulic escalator clam dredge	Potomac River, Maryland	Small clams overcame dredging effects better, sublegal clams not significantly reduced by dredging, recruitment of young clams increased, where number of adults was reduced by dredging	No major changes to sediment structure or grain size after dredging	Organic carbon in first inch of substrate redistributed and concentrated after dredging	Dredged bottom soft for 1 year, March and June dredging showed no difference in clam (>35 mm) densities after 4 months, August dredging: differed for 8-12 months	Pfitzenmeyer 1972a, 1972b
Sand to sandy mud	Hydraulic dredge	Chester River, Tributary to Chesapeake Bay, Maryland	Increased turbidity and light attenuation from dredging decreased light penetration impacting SAV, SAV tolerated reduced light for a day or two of clamming beyond that negative impacts	Plumes: significantly higher turbidity/light attenuation than background, decreased sediment compaction due to sediment type and water depth, plume dissipation linked to grain size	N/A	Plumes dissipated exponentially, rapidly at first as coarse particles settle, slowly for fine sediments, plumes in shallow water slower decay	Ruffin 1995

Table 1c. Dredging effects reported from research studies on harvest fishery of deepwater North and Mid-Atlantic clam species. N/A indicates no data.

Species	Habitat Sediment	Harvest Gear	Study Location	Biological Effects	Physical Effects	Chemical Effects	Recovery	Author
Arctic surfclam, *Mactromeris polynyma*	Medium grained sandy bank	Two hydraulic clam dredges, 4 m wide, 12 tons	Banquereau, Scotian Shelf, southeast Atlantic Canada	Density of large burrows reduced by 90% due to mortality of clams, polychaete tubes reduced, removal of empty shell from benthos	Sediment smoothing, dredge created 20 cm deep, 4 m wide curvilinear furrows, margins degraded by slumping, sediment transport and bioturbation	N/A	Lasting effects on sediment structure, no recovery of large burrows at 3 yrs, dredge tracks persist for 3 yrs, increase in polychaete tubes at 2 yrs, at 3 yrs 100% increase over predredge numbers	Gilkinson et al. 2003
Cyrtodaria siliqua, Arctica islandica, M. polynyma, Serripes groenlandicus	Medium grained sandy seabed	Two hydraulic clam dredges 4 m wide, 12 tons	Banquereau, Scotian Shelf Eastern Canada	40% decrease in macrofaunal abundance in furrows, damage to some clams, reduced biomass of target species, colonizing on-going for 2 years	Cutting depth to 20 cm	N/A	Marked increase in polychaete and amphipod abundance at 1 yr, opportunistic species increased by >100%, taxonomic distinctness declined, no recovery of target species at 2 yrs	Gilkinson et al. 2005
Arctic surfclam, *M. polynyma*	Sand with some rocks	New England hydraulic dredge	Gulf of St. Lawrence, Canada	Damage to <10% of surf clams, 50% of razor clams and a small number of other mollusks, 2/3 of clams remained on bottom, no long or short term harm to resident benthic species	Depth of impact 15 to 30 cm, sediment suspended for up to 30 minutes, sediments in tracks less compacted than adjacent areas	N/A	N/A	Lambert and Goudreau 1996

Table 1c, continued. Dredging effects reported from research studies on harvest fishery of deepwater North and Mid-Atlantic clam species. N/A indicates no data.

Ocean quahog, *Arctica islandica*	Very fine to medium sand, recently fished and abandoned bed, currently fished and unfished control	Hydraulic dredge	Continental shelf off coastal New Jersey	Abundance and species composition of benthic macroinvertebrates was not altered by dredging	Dredged areas had small shell fragments and gravel on the sand surface caused by resorting of sand by water jetting	N/A		MacKenzie 1982
Atlantic surfclam, *Spisula solidissima*	Fine, medium, and silty sands	1.2 m Hydraulic clam dredge	Offshore of Rockaway Beach, southwest Long Island New York	Predators more abundant in dredge track, densities back to normal after 24-hrs except moon snails increased, mortality was 30% when dredge efficiency was high	Initial dredge track conspicuous with smooth track shoulder, angled walls and a flat floor	N/A	Dredge tracks deteriorated rapidly and after 24 hrs became shallow depressions	Meyer et al. 1981

Table 1d. Dredging effects reported from research studies on assorted clam species in Florida. N/A indicates no data.

Target Species	Habitat Sediment	Harvest Gear	Study Location	Biological Effects	Physical Effects	Chemical Effects	Recovery	Author
Southern Quahog, *Mercenaria campechiensis,* Southern surfclam, *Spisula raveneli,* Sunray Venus clam, *Macrocallista nimbosa*	Variable sediment and seagrass	Maryland hydraulic escalator clam dredge	Tampa and Boca Ciega Bays, Cedar Keys, Tarpon Springs, Florida	No recolonization of seagrass turtlegrass *Thalassia testudinum* and *Syringodium filiforme,* no increase in clam set, no differences in fauna between dredged and control	Water jets penetrated to 18 inches, uprooted vegetation, tracks visible from 1- 86 days, some areas soft for >500 days, decrease in silt/clay after dredging	N/A	Some regrowth of alga *Caulerpa prolifera* at 86 days post dredging, trenches in sand filled in immediately, decrease in silt/clay resolved within a year	Godcharles 1971
Sunray Venus clam, *M. nimbosa*	Sandy substrate	Commercial hydraulic Nantucket clam dredge	northwest coast Florida	Dredging damaged beds of turtle grass, excessive hydraulic pressure forced organisms under cutting blade damaging them	Dredge filled rapidly with mud disturbing surface layers	N/A	N/A	Jolley 1972
Sunray Venus clam, *M. nimbosa*	Loose quartz sand	Nantucket hydraulic dredge	Bell Shoal, St. Joseph Bay, Florida	Numbers of fish increased after passage of the dredge, some shell breakage, overall operation of dredge was not harmful to marine environment, by-catch included other commercial clam species	Substrate was churned up to free clams	N/A	N/A	Stokes et al. 1968

Table 1e. Dredging effects reported from research studies on the Manila clam, *Ruditapes philippinarum*. N/A indicates no data.

Habitat Sediment	Harvest Gear	Study Location	Biological Effects	Physical Effects	Chemical Effects	Time to Recovery	Author
Firm coarse substrate with rocks	Hydraulic escalator dredge	British Columbia	Decline in harvest size clams, some mortality of legal and sublegal clams	Trenches 0.5 m deep, 2 m wide at 2-4 months, deep holes, mounds of side cast material 30 cm deep, empty shells	N/A	No significant clam recovery 16 months postharvest	Adkins et al. 1983
Soft bottom, clay	Rusca (iron cage) and rotating drum (iron) teeth rotate and wash clams from drum to conveyer	Venice Lagoon, Italy	Disturbance of benthic community, bottom sediments became azoic, decrease in abundance of benthic organisms	Resuspension of top sediment layer, brought deep anoxic layer near the bottom, harvest gear extends 10 cm deep, changes to sediment compaction	Depletion of oxidized sediment layer, effects on redox conditions Likely to affect nitrogen and phosphorus cycling	N/A	Badino et al. 2004
Sand silt clay	Simulated sediment dredging	Sacca di Goro, Italy	Not measured with regard to simulated dredging	Resuspension of surface sediment, cultivated sediments more reduced than control	Rapid depletion of oxygen in water overlying sediments	N/A	Bartoli et al. 2001
Intertidal sandflats, *Lanice conchilega* beds	Tractor-towed sifter	Chausey archipelago Normandy France	Decreased densities of worm *L. conchilega* and abundance and diversity of macrofauna	Sifted top 10 cm of substrate	N/A	N/A	Godet et al. 2009
Mud flat with clay, fine sand and silt	Suction dredge	Southeast England	Reduction in density of individuals, number of species and diversity	Removed larger sand fractions down to the underlying clay substrate, sediment resuspended by dredge, exposing clay	N/A	No difference in infaunal communities in dredge and control areas by 7 months, sediment structure restored by sedimentation	Kaiser et al. 1996

Table 1e, continued. Dredging effects reported from research studies on the Manila clam, *Ruditapes philippinarum*. N/A indicates no data.

Silty-sand	Hydraulic dredge	Venice Lagoon near port of Malamocco Italy	Nonselective reduction in species abundance, both those captured and those resuspended in the sediment plume and transported by currents	Produced deep 20 cm furrows affecting texture of the bottom	N/A	After 60 days, non-opportunistic species assume opportunistic behavior during initial recolonization in dredge areas	Pranovi et al. 1998
Lagoon	Mechanical rusca (iron cage) dredge	Venice Lagoon, Italy	Enhanced clam growth, negative effects on some benthic invertebrates and detritivorous fish, positive effects on macrophytal grazers, reduced macroalgae	Resuspended sediments provide a food source for clams, especially juveniles, decreased light transmittance and water transparency	Removal of bioturbators affects sediment biogeochemistry since harvesting is a strong mixing force	N/A	Pranovi et al. 2003
Transition from silt/ silt-clay (15 years ago) to sand or silty-sand	Hydraulic dredging	Central Venetian Lagoon, Italy	Significant changes in total abundance and biomass, no *Zostera* colonization and diffusion, scavengers increased	Furrow 8- 10 cm deep, no immediate changes in sieve fractions, long term effects on sieve fractions from loss/redistribution of fine sediments	N/A	Furrows visible for 2 months, differences in biological community for 60 days, long term changes in particle size and sediment texture	Pranovi and Giovanardi 1994
Muddy sand	Suction harvesting	River Exe, Devon, United Kingdom	Invertebrate abundance and species diversity reduced by >90%	Increased sediment load in water, 10 cm deep trench	Suspended particles settled downstream, dispersed to background levels 40 m from dredge	Rapid recovery of invertebrates (spring recruitment) within 8 months of harvest, trenches refilled in 3-4 months	Spencer 1997
Muddy sand	Suction dredge	River Exe, Devon, United Kingdom	Immediate 80% reduction in infaunal species abundance	Created 10 cm deep trenches which took 2-3 months to refill	N/A	Sediment structure and invertebrate infaunal community recovered by 12 months	Spencer et al. 1996, 1997, 1998

Table 1f. Dredging effects reported from research studies on clam species from Portugal. N/A indicates no data.

Target species	Habitat Sediment	Harvest Gear	Study Location	Biological Effects	Physical Effects	Chemical Effects	Recovery	Author
Spisula. solida, Donax trunculus, Venus striatula, Pharus legumen, Enis siliqua	Soft-bottom	Portuguese dragged, toothed iron clam dredge	Algarve coast, South Portugal	Decrease in abundance of meiofauna and macrofauna, target and fragile taxa predators increased	Dredge penetrated up to 50 cm depth, sediment redistribution	N/A	N/A	Alves et al. 2003
S. solida D. trunculus, V. striatula, P. legumen, E. siliqua	Sand	Dragged iron bivalve dredges	Algarve coast, south Portugal	Macrofaunal distribution, diversity, evenness, number of taxa and abundance varied across dredge track	A sand buffer formed in front of the dredge mouth pushing sediment sideways	N/A	N/A	Chícharo et al. 2002a
S. solida	Sandy sediment grain sizes 0.5 and 0.355 mm	Dragged iron bivalve dredges	Algarve coast, south Portugal	Increased number of exposed clams, predators increased 6-9 min after dredging: *Ophiura texturata, Pomatochistus spp., Diogenes pugilator, Nassarius reticulatus*	N/A	N/A	N/A	Chícharo et al. 2002b
S. solida	Simulated sand dredge tracks	Laboratory simulated bivalve dredge	Algarve coast, south Portugal	Sublethal effects on clams: decreased RNA/DNA and N/P lipid ratio, decline in condition	N/A	N/A	Clam condition improved after spawning season	Chícharo et al. 2003

Table 1f, continued. Dredging effects reported from research studies on clam species from Portugal. N/A indicates no data.

S. solida, D. trunculus	Coarse sand and gravel	Towed clam dredge	Algarve, southern Portugal	Impacts greater at 18 m depth: macrobenthic organisms showed reduced abundance, number of taxa, and diversity, decrease in meiofauna abundance number of taxa	Sediment morphology and texture affected, dredge track measured 30 cm wide and 10 cm deep	N/A	Faster biological recovery at 6 versus 18 m, meiofauna recovered by 35 days, tracks at 6 m gone after 24 hrs but still visible at 18 m for 13 days, at 6 m grain size was similar to control by 17 days, at 18 m 1 day after dredging, slight increase in grain size, by 13 days dredged similar to control	Constantino et al. 2009
S. solida, D. trunculus, E. siliqua, P. legumen	Shallow sandy	Mechanical metal bivalve dredge	Vilamoura and Armona, Algarve coast, Portugal	N/A	Formation of a furrow exposing underlying sand with a spoil ridge on either side of the depression	Porewater nitrates, ammonium, organic nitrogen, phosphate and silicate decreased post-dredging and increased in near bottom water	Reestablishment of the seabed was reached within a short time at both stations	Falcão et al. 2003
Chamelea gallina, D. trunculus, S. solida, Tellina tenuis	Sand and sandy-mud bottom	Portuguese clam dredge	Lagos in South Portugal	Low damage and mortality of macrobenthic animals in dredge path, scavengers attracted in high densities, but dissipated rapidly	Suspended sediment settled rapidly in sand and mud, tracks deeper and more persistent in sandy mud , tracks eroded via wave action and currents	N/A	Undamaged or slightly damaged shellfish reburied immediately after escaping the dredge	Gaspar et al. 2003

Table 1g. Dredging effects reported from research studies on the Striped Venus clam *Chamelea gallina*. N/A indicates no data.

Habitat Sediment	Harvest Gear	Study Location	Biological Effects	Physical Effects	Chemical Effects	Recovery	Author
Two sites: sand vs. mud	Hydraulic dredge using high and low water pressure	North Adriatic Sea	High pressure treated clams had lower adenylate energy charge than low pressure, high pressure treated clams burrowed less	Grain size influenced speed and operation of dredge, impacts were greater on mud bottom	N/A	Juvenile clams returned to water after dredging reburrow slowly and are subject to predation	Da Ros et al. 2003
N/A	Dredging with high pressure water jets with sieve sorting versus low pressure water jets	Lido coast, Lagoon of Venice, Adriatic Sea	At high pressure clam filtration rates decreased , respiration rates increased, lower scope for growth, hematocrit and phagocytic index decreased, reduced acid phosphotase and increased β-glucuronidase activity	N/A	N/A	N/A	Marin et al. 2003
Fine sand	2.4 -3 m wide, 0.6 - 0.8 ton hydraulic dredge	Adriatic Sea, Italy	No effects to macrobenthic community (polychates, crustaceans, detritivores and suspensivores), mollusks and bivalve *Abra alba* were affected, short term pulse impact on scavengers and predators	N/A	N/A	N/A	Morello et al. 2005
Fine sand	Hydraulic clam dredge	Adriatic Sea, Italy	Depth strata and fishing intensity affected dredge impact, moderate disturbance to benthic community and significant difference in species number and evenness between fishing intensity at 4-6 m, reduction in evenness at high intensity, increased species number with decreasing intensity	N/A	N/A	Recovery of benthic community within 6 m	Morello et al. 2006

Table 1g, continued. Dredging effects reported from research studies on the Striped Venus clam *Chamelea gallina*. N/A indicates no data.

Jesolo; fine sand, Lido; medium grain sand	Hydraulic dredge, high and low pressure without sorting, high pressure with sorting	Jesolo and Lido, Northern Adriatic Sea, Italy	Water pressure and sorting increased shell damage, the larger the clam the more damage it sustained, some clams survived damage	N/A	N/A	N/A	Moschino et al. 2002, 2003
Jesolo; fine sand, Lido; medium grain sand	Hydraulic dredge, high and low pressure without sorting, high pressure with sorting	Jesolo and Lido, Northern Adriatic Sea, Italy	High water pressure and mechanized sorting decreased clearance rates, scope for growth, and survival in air, season may increase affects	N/A	N/A	N/A	Moschino et al. 2008
N/A	Experimental hydraulic dredge with vibrating bottom grid	Adriatic Sea North of port of Giulianova, Italy	As compared to standard gear: larger number of damaged shells, better size selectivity and escape of undersized clams and discarded fauna, reduced by-catch, enhanced quality of commercial product	N/A	N/A	N/A	Rambaldi et al. 2001

Table 1h. Dredging effects reported from research studies on the razor clam, *Ensis* sp. N/A indicates no data.

Habitat Sediment	Harvest Gear	Study Location	Biological Effects	Physical Effects	Chemical Effects	Recovery	Author
Clam bed	Hydraulic dredge	Gormanston, Irish Sea	Reduced dominant and target species, increased infaunal community diversity, increase in scavengers and predators, *Lanice conchilega* tube worm eliminated, *E. siliqua* replaced by suspension feeder *Lutraria lutraria*	Dredging to 30 cm deep, increase in larger grain sizes and sorting coefficients, high content of broken shell	N/A	Initial increase in diversity, followed by a downward trend	Fahy and Carroll 2007
Clean sandy bottom	Two dredges, varying tooth lengths	Lagos, south Portugal	10-15% by-catch damage to clams reduced by increased tooth length and decreased tow duration, injury inversely proportional to catch efficiency	Physical impact of dredge of short duration	N/A	Dredge tracks erased within 24 hrs	Gaspar et al. 1998
Sand	Hydraulic suction dredging	Loch Gairloch, Ross-shire, Scotland	Reduction in target species, increased scavengers, reduced number of macrofaunal species and individuals after 1 day	Physical disturbance, trenches and holes, area affected 20-30%	N/A	Trenches and holes resolved within 40 days, macrofauna recovered by 40 days	Hall et al. 1990
Maerl	Hydraulic blade dredge	Clyde Sea, Scotland	Kelp coated with mud, both seaweed and sessile biota buried with silt, fragile organisms damaged, increase in predators post-dredging	Changed from sandy gravel to gravelly sand, suspended sediment reduced visibility, dredge track formed, snow-plough effect, altered sediment to 9 cm	N/A	Sediment settled within 1hour, track partially eroded within 1month, depth and width reduced by wave action	Hauton et al. 2003a
Sand	Hydraulic blade dredge	Clyde Sea, Scotland	Survival of 60-70% of dislodged fauna mostly urchin *Echinocardium cordatum,* 20-100% of target clams damaged	Tracks of fluidized sand beds	N/A	Reburial of 80-90 % of clams within 30 min, a few still unable to rebury after 3 hrs	Hauton et al. 2003b

Table 1h, continued. Dredging effects reported from research studies on the razor clam, *Ensis* sp. N/A indicates no data.

Coarse sand and shell	Hydraulic dredge	Clyde Sea, Scotland	Some damage of larger versus clams	Dredged area 45 cm swath, 80 cm disturbed, surface width of dredge track was 1.01 m	N/A	N/A	Hauton et al. 2007
sand	Hydraulic dredge	Clyde Sea, Scotland	N/A	Suspended fine sediment into water column, resettled in dredge track, sediment reduced from moderately to poorly sorted, dredge left 13.9 cm tracks of fluidized sand, eliminated stratification, sediments vertically homogenous to 20 cm	N/A	After 100 days, wave action and bioturbation reduced tracks to 2.9 cm depth, tracks now shallow furrows, width increased from 100- 115 cm	Hauton and Paterson 2003
Fine sand and open broken shell	Suction dredging	Orphir Bay and Bay of Ireland, Orkney Islands, United Kingdom	Lower density and smaller mean length of clams from dredged area, breaks in shell margin, sand grains embedded in deep clefts in the shell matrix	N/A	N/A	Some clams showed slow initiation of escape digging and increased vulnerability to predator attack	Robinson and Richardson 1998
Sand	Water jet dredging	Outer Hebrides-Western Isles, United Kingdom	Initial removal of infauna, damage to 10-28%, scavengers attracted to tracks, immediate reduction in number of species, individuals, and biomass, no change in diversity, reduced polychaetes, increase in amphipods, damage to large bivalve by-catch	Immediate physical effects apparent, visible dredge tracks up to 2 m wide, fluidized sediment, reduction in % silt immediately after dredging, elevated turbidity	N/A	Dredge tracks refilled after 5 days, and were no longer visible at 11 weeks, sediment remained fluidized, % silt returned to normal at 5 days	Tuck et al. 2000

Table 1i. Dredging effects reported from research studies on Pacific Northwest clam species. N/A indicates no data.

Target Species	Habitat Sediment	Harvest Gear	Study Location	Biological Effects	Physical Effects	Chemical Effects	Recovery	Author
Saxidomus gigantea, Leukoma staminea, R. philippinarum	Firm coarse substrate with rocks	Hydraulic escalator harvester	British Columbia	Decline in harvest size clams, mortality of legal and sublegal clams	Trenches 0.5 m deep, 2 m wide at 2-4 months, deep holes, mounds of side cast material 30 cm deep, empty shells	N/A	No significant clam recovery 16 months postharvest	Adkins et al. 1983
S. gigantea, P. stamina, Tresus capax, Tresus nuttallii	Sand, gravel and shell substrate	Hydraulic escalator harvester	Agate Passage, Puget Sound, Washington	Reduced abundance of attached kelp, little effect on number of benthic species, reduced number of individuals and weight of organisms	Changes in substrate distribution, shell left on substrate surface, no effects on percentage of fine substrate	Chemical measurements in harvested areas were reduced or unchanged versus control likely due to reduced biomass	Most species recovered to control levels within 2 yrs	Goodwin and Shaul 1978
S. gigantea, P. staminea	Sand, gravel and shell, some eelgrass beds (which dredge avoided)	Hanks hydraulic escalator harvester	Puget Sound, Washington	Smothering of some adult clams	Visible tracks and furrows, decrease in sediment compactness, transient sandbar, loosening, emulsification and loss of vertical stratification	N/A	Beach recovered in 1.5 yrs, tracks no longer visible, good clam set	Goodwin and Shaul 1980

Table 2. Dredging effects reported from research studies on the Eastern oyster *Crassostrea virginica*. N/A indicates no data.

Habitat Sediment	**Harvest Gear**	**Study Location**	**Biological impacts**	**Physical Impacts**	**Chemical impacts**	**Recovery**	**Author**
Intertidal	Mechanical oyster harvester	South Carolina	No detectable damage to oyster shell matrix, 5% of harvested oysters were damaged	N/A	N/A	N/A	Collier and McLaughlin 1983 (abstract)
Oyster bottom	Hydraulic escalator dredge	Patuxent River, Maryland	Minor effect of heavy particles on oysters within 15 ft of dredging, infauna not significantly reduced in dredge and impact areas, no affect on juvenile clams, 100% mortality and burial of oysters in dredged area, disruption of epibenthic community	Substrate surface color was lighter than on undisturbed bottom, troughs and ridges in dredged area, suspension of sediment high compared to background, no significant change in particulate fraction in impact area	No toxic substances detected after dredging	Reestablishment of infauna in dredged area rapid, 3 days after dredge no alteration of bottom, no accumulation of displaced substrate, no burial of oysters or cultch	Drobeck and Johnson 1982
High and low intertidal oyster reefs	Mechanical oyster harvester	Beaufort County, South Carolina	Oyster biomass declined in high and low intertidal, species density correlated with oyster biomass, reduced faunal density in high intertidal with target species number and frequency unaffected by harvest, diversity and evenness in harvested high intertidal > than control	Some areas appeared undisturbed, others had tracks and deep depressions	N/A	Oyster biomass in high intertidal remained low, oyster spat were attracted after harvest	Klemanowicz 1985, Manzi et al. 1985

Table 3. Dredging effects reported from research studies on the blue mussel, *Mytilus edulis*. N/A indicates no data.

Intertidal sublittoral	Dutch and Baird dredges	Menai Straits, North Wales	Shell damage to 13% of mussels from rotary sorting and 1.6% damaged by dredging, up to 5% of small mussels destroyed by dredge and sorting induced shell fractures	N/A	N/A	Mussels with light damage were still alive 72 hours after sorting	Dare 1974
Two sites, sand and mud	2-3 m width single commercial dredge and otter trawls	Lower Narragansett Bay and Rhode Island Sound, Rhode Island	N/A	Scars from dredging and trawling are short lived in sand and shoal waters and longer lasting in deep water and mud	N/A	Bottom scars in shallow sand substrate resolved in 1 to 4 days, 60 days in deep mud substrate	DeAlteris et al. 1999
Mussel beds with bare mud flats	Dutch mussel dredge, 1.8 m wide, 250 kg	Danish Sound, Limfjorden, Denmark	Reduced density of polychaetes, reduced species number, increase in shrimp *Crangon crangon*	Dredging formed 2-5 cm deep furrows, no change to sediment texture or organic content	N/A	Reduced species number in dredge area lasted 40 days, increase in species number outside dredge area for 7 days	Dolmer et al. 2001
Mud, silt and clay	Commercial mussel dredge	Maquoit Bay, Maine	Dragging disturbed 10% of eelgrass in study area, removing plant materials above and below ground	Dragging did not affect physical characteristics of the sediment	N/A	After 1yr eelgrass shoot density, height and total biomass reduced, reduced biomass persisted for >7 yrs , pattern and rate of recovery proportional to drag intensity	Neckles et al. 2005

Table 4. Dredging effects reported from research studies *on the cockle Cerastoderma* edule. N/A indicates no data.

Habitat Sediment	Harvest Gear	Study Location	Biological Impacts	Physical Impacts	Chemical Impacts	Recovery	Author
Two sites, mud and sand, intertidal	Tractor towed cockle harvester	Burry Inlet, Wales	Loss of common invertebrates, decreased species richness at both sites, dominance declined in sand area, community in clean sand recovered more quickly than mud	Physical disruption to the complex layered structure of the sediment	Anoxic layer was brought to the surface and dispersed	Modest recovery occurred in sand, in mud *Pygospio elegans* and *Hydrobia ulvae* (gastropods) remained depleted for 100 days, Nephtys *hombergi* (polychaete), *Scoloplos armiger* and *Bathyporeia pilosa* (amphipod) for 50 days	Ferns et al. 2000
Silty sediments, coarser toward center of bay	Hydraulic suction dredge and tractor dredge	Auchencairn Bay, Dumfriesshire Scotland	High mortality of nontarget benthic fauna, considerable survival in suction dredged areas, reduced abundance of individuals and species	Dredge tracks did not persist	N/A	Faunal structure in suction dredged plots recovered by 56 days	Hall and Harding 1997
Intertidal flats	Suction dredge	Dutch Wadden Sea	Densities of *M. balthica* lower in dredged areas, reduction in density of non-target species	Sediment removed and disturbed by dredging, less suitable for settlement by *Macoma balthica* and *Mytilus edulis*	N/A	Densities of nontarget fauna lower in dredged areas up to 1 yr later	Hiddink 2003
Sandy intertidal flats	Suction dredge	Griend, Dutch Wadden Sea	Significant negative effect of dredging on settlement of cockles, declines in bivalve stocks linked to reduced settlement	Dredging increased sediment grain size while silt was lost	N/A	Initial sediment characteristics returned,, long lasting (8 yr decline) negative effects on bivalve recruitment	Piersma et al. 2001