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Web resources:

Carpentaria Ghostnets Programme – www.ghostnets.com.au

Derelict fishing gear recovery in California, USA – www.mehp.vetmed.ucdavis.edu/derelictgear.html

Global Marine Litter Information Gateway – www.marine-litter.gpa.unep.org/cases/shipping-fishing.htm

Monofilament line collection and recycling – www.healthebay.org/news/2007/08_02_monofilament/default.asp

SeaNet Program involving outreach to fishing industry on developing technical solutions to improve sustainability – www.oceanwatch.org.au/snindex.htm

Glossary

Term	Explanation
Abandoned fishing gear	Fishing gear that is deliberately left at sea with no intention by fishers to retrieve it, for whatever reason.
ALDFG	Collective term for fishing gear that has been abandoned, lost or otherwise discarded (see separate glossary entries). Often referred to as "derelict fishing gear" in literature.
Creeper	A device used to retrieve abandoned, lost or otherwise discarded fishing gear.
Curative management	Management approach that seeks to reduce the extent of ALDFG (i.e. *ex-post* as opposed to *preventative management* which attempts to prevent gear being abandoned, lost or otherwise discarded *ex-ante*).
Discarded fishing gear	Fishing gear or parts thereof that is deliberately thrown overboard without any intention for further control or recovery.
Drifting longline	Consists of a mainline kept near the surface or at a certain depth by means of regularly spaced floats and with relatively long snoods with baited hooks, evenly spaced on the mainline. Drifting longlines may be of considerable length exceeding 80 km. Mainlines and leader lines are almost exclusively made from synthetic materials.
Fish aggregating device (FAD)	Moored or free-floating structures placed in the open ocean with the primary function of aggregating fish to increase their catchability.
Fishing gear[1]	Tools for the capture of aquatic resources. This definition includes all items/elements onboard fishing vessels that are used for fishing purposes, including fish aggregating devices (FADs).
Fleet (of nets)	Two or more gillnets which are connected.
Fyke net	Normally used in shallow water, consists of a cylindrical or cone-shaped bags mounted on rings or other rigid structures, completely covered by netting and completed by wings or leaders which guide the fish towards the opening of the bags. Fyke nets, fixed on the bottom by anchors, ballast or stakes, may be used separately or in groups.
Gear conflict	An event where one form of fishing activity interferes with another, potentially resulting in the loss of one or both types of fishing gear. For example, this may occur when a towed gear (e.g. trawl) cuts across static gear (e.g. gillnet).

[1] For a detailed description of fishing gears see *FAO Fisheries Technical Paper* No. 222 Rev. 1.

Ghost fishing	The term used to describe the capture of marine organisms by lost, abandoned or otherwise discarded fishing gear or parts thereof. Effectively, the capture of fish and other species that takes place after all control of fishing gear is lost by a fisher[2]. For example, a lost, abandoned or discarded gillnet might continue to fish with consequent mortality to the enmeshed fish. Ghost fishing is often cyclical and the pattern, duration and extent will depend on a large number of factors including the gear type, water depth, currents and local environment.
Gillnets/ entangling nets/ tangle nets	Strings of single, double or triple netting walls, vertical, near the surface, in midwater or at the bottom, in which fish will gill, entangle or enmesh. These nets have floats on the upper line (headrope) and, in general, weights on the ground line (footrope). Several types of nets may be combined in one gear (for example, gillnet combined with trammel net). These nets can be used either alone or, as is more usual, in large numbers placed in line ("fleets" of nets). The gear can be, anchored to the bottom or left drifting, free or connected with the vessel.
Ground	The seabed substrate. Often described as soft or open ground (i.e. sandy or muddy) or hard or rocky ground (substrate with obstructions that might snag or damage fishing gear).
Lost fishing gear	The accidental loss of fishing gear at sea.
Mobile gear	Fishing gear that is towed by a vessel to displace and capture fish. Sometimes called active or towed gear. Examples include trawls and dredges.
Net sheet	A portion of netting typically joined together with other sheets.
Preventative management	Management approach that seeks to prevent the initial loss of gear (i.e. an *ex-ante* measure as opposed to *curative management* that is implemented *ex-post*).
Purse seine	A long wall of netting framed with floatline and leadline (usually, of equal or longer length than the former) and having purse rings hanging from the lower edge of the gear. Through the purse rings runs a purse line made from steel wire or rope which allows the pursing of the net. For most situations, purse seine is the most efficient gear for catching large and small pelagic species that are shoaling.
Retrieval	A process by which ALDFG fishing gear is recovered using towed trawls, grapnels, divers, remotely operated vehicles or other specialist equipment.
Set longline	Consists of a mainline and secondary lines with baited (occasionally un-baited) hooks at intervals. The number of hooks, distance of snoods on the mainline, and length of the snoods depends on the target species, the handling capacity and technology used. Longlines can be set as bottom lines (including on very rough bottom and/or coral reefs) or in midwater or even not far from the surface. Its length can range from a few hundred metres in coastal fisheries to more than 50 km in large-scale mechanized fisheries.

[2] Some variation of this definition could be considered in cases where fishers do not abandon, lose or discard gear, but leave it in the water for longer periods than is deemed appropriate to retrieve catch of a marketable quality.

Soak time	The period for which fishing gears are deployed in the water before being removed/recovered.
Static gear	Fishing gear that is placed in one fixed location, usually through anchors and buoys, so that it traps or ensnares passing fish. Static gear includes types of nets, pots and traps. Some gear may be baited to improve fishing efficiency. This gear is sometimes called passive gear, in that no energy is expended during the actual fishing process.
Trammel net	Bottom-set entangling net made with three walls of netting, one or more outer walls being of a larger mesh size than the loosely hung inner netting sheet. The fish get entangled in the inner small meshed wall after passing through the outer wall, thus trapping rather than gilling it.
Traps/pots	Traps, large stationary nets, or barrages or pots, are gears in which the fish are retained or enter voluntarily and are then hampered from escaping. They are designed in such a manner that the entrance operates as a non-return device, allowing the fish to enter the trap but making it impossible to leave the catching chamber. Different materials are used for building a trap or pot; wood, split bamboo, netting, and wire are some examples. Due to the lack of standardization in the literature, the terms "pots" and "traps" are used interchangeably throughout this report.
Trawl	A cone-shaped net (made from two or more sheets of netting), that is towed, by one or two boats, on the bottom or in midwater (pelagic). The cone-shaped body ends in a bag or cod-end. The horizontal opening of the gear while it is towed is maintained by beams, otter boards or by the distance between two towing vessels (pair trawling). Floats and weights and/or hydrodynamic devices provide for the vertical opening. Two parallel trawls might be rigged between two otter boards (twin trawls).
Vertical line (or recreational "hook & line")	Consists of a line to which is attached sinker and one or several hooks, used in both commercial and recreational fisheries. In commercial fisheries, the lines have usually several hooks. The additional hooks can be fixed on the mainline at short intervals with branch lines of a certain length. A special form of vertical line is a jigger line, mostly used in the fisheries for squid. Special squid jiggers (ripped hooks) are mounted one after the other at a certain distance with a monofilament line. The line weighed down by sinkers can be set up to 200 m in depth and is hauled with jerky movements.

Appendix A

United Nations General Assembly Resolutions related to ALDFG

Resolution A/RES/59/25 Sustainable Fisheries (United Nations, 2004)

> *"60. Calls upon States, the Food and Agriculture Organization of the United Nations, the International Maritime Organization, the United Nations Environment Programme, in particular its Regional Seas programme, regional and subregional fisheries management organizations and arrangements and other appropriate intergovernmental organizations that have not yet done so to take action to address the issue of lost or abandoned fishing gear and related marine debris, including through the collection of data on gear loss, economic costs to fisheries and other sectors, and the impact on marine ecosystems;*
>
> *61. Requests the Secretary-General, in his next report concerning fisheries, to include information on the actions taken by the Food and Agriculture Organization of the United Nations, the United Nations Environment Programme, in particular its Regional Seas programme, the International Maritime Organization, regional and subregional fisheries management organizations and arrangements, and other appropriate intergovernmental organizations, to give effect to paragraph 60 above;*
>
> *62. Urges States to ratify and implement relevant international agreements, including annex V to the International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978 relating thereto;*
>
> *63. Calls upon States, where relevant, to establish systems for retrieving lost gear and nets;"*

Resolution A/RES/60/30 - Oceans and the Law of the Sea (United Nations, 2006a)

> *"65. Notes the lack of information and data on marine debris, encourages relevant national and international organizations to undertake further studies on the extent and nature of the problem, also encourages States to develop partnerships with industry and civil society to raise awareness of the extent of the impact of marine debris on the health and productivity of the marine environment and consequent economic loss;*
>
> *66. Urges States to integrate the issue of marine debris into national strategies dealing with waste management in the coastal zone, ports and maritime industries, including recycling, reuse, reduction and disposal, and to encourage the development of appropriate economic incentives to address this issue, including the development of cost recovery systems that provide an incentive to use port reception facilities and discourage ships from discharging marine debris at sea, and encourages States to cooperate regionally and sub-regionally to develop and implement joint prevention and recovery programs for marine debris;*
>
> *67. Invites the International Maritime Organization, in consultation with relevant organizations and bodies, to review annex V to the International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978 relating thereto, and to assess its effectiveness in addressing sea-based sources of marine debris;*
>
> *68. Welcomes the continued work of the International Maritime Organization relating to port waste reception facilities, and notes the work done to identify problem areas and to develop an action plan addressing the inadequacy of such facilities;"*

Resolution A/RES/60/31 (United Nations, 2006b)

> *"77. Calls upon States, the Food and Agriculture Organization of the United Nations, the International Maritime Organization, the United Nations Environment Programme, in particular its Regional Seas programme, regional and sub-regional fisheries management*

organizations and arrangements and other appropriate intergovernmental organizations that have not yet done so to take action to address the issue of lost or abandoned fishing gear and related marine debris, including through the collection of data on gear loss, economic costs to fisheries and other sectors, and the impact on marine ecosystems;

78. Encourages close cooperation and coordination, as appropriate, between States, relevant intergovernmental organizations, United Nations programmes and other bodies, such as the Food and Agriculture Organization of the United Nations, the International Maritime Organization, the United Nations Environment Programme, the Global Program of Action, and Regional Seas arrangements, regional and sub-regional fisheries management organizations and arrangements and relevant stakeholders, including non-governmental organizations, to address the issue of lost and discarded fishing gear and related marine debris, through initiatives such as analysis of the implementation and effectiveness of the existing measures relevant to the control and management of derelict fishing gear and related marine debris, the development and implementation of targeted studies to determine the socio-economic, technical and other factors that influence the accidental loss and deliberate disposal of fishing gear at sea, the assessment and implementation of preventive measures, incentives and/or disincentives relating to the loss and disposal of fishing gear at sea, and the development of best management practices;

79. Encourages States, directly and through regional and sub-regional fisheries management organizations and arrangements, and in close cooperation and coordination with relevant stakeholders, to address the issue of lost and discarded fishing gear and related marine debris, through initiatives including developing and implementing joint prevention and recovery programs, establishing a clearinghouse mechanism to facilitate the sharing of information between States on fishing net types and other fishing gear, the regular, long-term collection, collation and dissemination of information on derelict fishing gear, and national inventories of net types and other fishing gear, as appropriate;

80. Encourages States, the United Nations Environment Programme, the Global Program of Action, the Food and Agriculture Organization of the United Nations, the International Maritime Organization, sub-regional and regional fisheries management organizations and arrangements and other relevant intergovernmental organizations and programs to consider the outcomes of the Asia-Pacific Economic Cooperation Education and Outreach Seminar on Derelict Fishing Gear and Related Marine Debris, held in January 2004, and how they may be implemented;

81. Encourages States to raise awareness within their fishing sector and sub-regional and regional fisheries management organizations and arrangements of the issue of derelict fishing gear and related marine debris and to identify options for action;

82. Encourages the Committee on Fisheries to consider the issue of derelict fishing gear and related marine debris at its next meeting in 2007, and in particular the implementation of relevant provisions of the Code;"

Resolution A/RES/61/222 (United Nations, 2007a)

78. Welcomes the activities of the United Nations Environment Programme relating to marine debris carried out in cooperation with relevant United Nations bodies and organizations, and encourages States to further develop partnerships with industry and civil society to raise awareness of the extent of the impact of marine debris on the health and productivity of the marine environment and consequent economic loss;

79. Urges States to integrate the issue of marine debris into national strategies dealing with waste management in the coastal zone, ports and maritime industries, including recycling, reuse, reduction and disposal, and to encourage the development of appropriate economic incentives to address this issue, including the development of cost recovery systems that provide an incentive to use port reception facilities and discourage ships from discharging marine debris at sea, and encourages States to cooperate regionally and sub-regionally to develop and implement joint prevention and recovery programs for marine debris;
80. Welcomes the decision of the International Maritime Organization to review annex V to the International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978 relating thereto, 42 to assess its effectiveness in addressing sea-based sources of marine debris, and encourages all relevant organizations and bodies to assist in that process;

Resolution A/RES/61/105 (United Nations, 2007b)

"94. Reaffirms the importance it attaches to paragraphs 77 to 81 of its resolution 60/31 concerning the issue of lost, abandoned, or discarded fishing gear and related marine debris and the adverse impacts such debris and derelict fishing gear have on, inter alia, fish stocks, habitats and other marine species, and urges accelerated progress by States and regional fisheries management organizations and arrangements in implementing those paragraphs of the resolution;95. Further encourages the Committee on Fisheries of the Food and Agriculture Organization of the United Nations to consider the issue of derelict fishing gear and related marine debris at its [next] meeting in 2007, and in particular the implementation of relevant provisions of the Code;"

Appendix B

Survey and personal contacts made during this study

Name	Organization	Survey respondent
Adler, Ellik	UNEP	
Agnew, David	Imperial College London	
Anon.	North East Atlantic Fisheries Commission (NEAFC)	Yes
Breen, Mike	International Council for the Exploration of the Sea (ICES) – Fisheries Research Service (FRS), Aberdeen	
Broadhurst, Ginny	Northwest Straits Commission, USA	
Chakalall, Bisessar	FAO Subregional Office for the Caribbean (SLAC)	
Chopin, Francis	FAO Fishing technology Service (FIIT)	
De Rozarieux, Nathan	Seafood Cornwall, UK	
Donohue, Mary	Sea Grant College Program, University of Hawaii, USA	Yes
Espy, Leigh	National Oceanic and Atmospheric Administration (NOAA)	
Ferro, Dick	Fisheries Research Service (FRS), Aberdeen	
Fitzpatrick, John	FAO Fishing technology Service (FIIT)	
Gilardi, Kirsten	SeaDoc Society, California Fishing Gear Retrieval Programme	
Gillett, Bob	Independent Consultant	
Gregory, Murray	University of Auckland, NZ	
Jeftic, Ljubomir	UNEP Consultant	
Joseph, Leslie	Independent Consultant	
June, Jeff	Natural Resources Consultants, Inc., USA	Yes
Kiessling, Ilse	Department of the Environment & Water Resources, Northern Territory, Australia	
Matulessy, Luna	International Finance Corp. (IFC)	
Moloney, Brett	South Pacific Commission (SPC)	
Morgan, Gary	Regional Organization for the Protection of the Marine Environment (ROPME)	

Parry, Neal	National Oceanic and Atmospheric Administration (NOAA) Marine Debris Program	Yes
Phillips, Michael	Network of Aquaculture Centres in Asia-Pacific (NACA)	
Raaymakers, Steve	Consultant, Australia	
Rihan, Dominic	Bord Iascaigh Mhara (BIM), Ireland	Yes
Rose, Craig	Alaska Fisheries Science Center, USA	Yes
Simonds, Kitty	Western Pacific Fishery Management Council, Hawaii, USA	Yes
Tambunan, Gomal H.	Network of Aquaculture Centres in Asia-Pacific (NACA) – Escolas Técnicas do Estado de São Paulo (ETESP)	
Tietze, Uwe	FAO Fishing Technology Service (FIIT) (retired)	
Valdemarsden, John W.	Institute of Marine Research (IMR), Norway	Yes
Vassilopoulou, Vassiliki	Hellenic Centre for Marine Research (HCMR), Greece	Yes

Appendix C

Summary of survey results

1. Please would you tick the one box below that best describes which sector you work for or in

Answer Options	Response Percent
private sector	0.00%
government	60.00%
international organisation	10.00%
regional organisation	10.00%
representative organisation (e.g. producer organisation)	0.00%
NGO	10.00%
Research	10.00%

2. Please indicate in which region of the world you are based

Answer Options	Response Percent
Europe	50.00%
North America	30.00%
South America	0.00%
Pacific	20.00%
Asia	0.00%
Africa	0.00%
Middle East	0.00%
Other	0.00%

3. Please rank the following gear types in terms of how much ALDFG (in volume terms) you think they generate in your region (e.g. tick 1 for the most important gear type, 2 for the next most important, etc)

Answer Options	1	2	3	5	6	Rating Average
Gill nets	6	1	0	0	0	2
Pots/traps	1	3	3	1	0	2.63
Mobile gear/trawls	2	2	2	0	0	2.5
Longlines	0	3	3	0	0	3
Jigs	0	0	0	2	4	5.67
Aquaculture	0	0	1	5	2	5

4. For each gear type, which of the following impacts of ALDFG on the marine environment do you think are PARTICULARLY significant in your region (you may tick more than one impact for each gear)? (in relation to aquaculture we are thinking of lost cages, etc)

Answer Options	Ghost fishing of target species	Ghost fishing of non-target species	Navigational hazards	Ingestion by other species	Phyiscal impacts on the benthic/bottom environment
Gill nets	7	9	2	1	4
Pots and other forms of traps	6	6	1	0	3
Mobile gear/ trawls	2	5	5	0	7
Longlines	4	4	1	1	0
Jigs	0	0	0	0	0
Aquaculture	0	1	2	1	4

5. For each gear type could you please indicate which you think are the PRINCIPAL causes of ALDFG (you may tick more than one cause for each gear type)?

Answer Options	Gear conflicts	Poor weather	Economic reasons	Lack of port-side collection		IUU fishing	Other
Gill nets	5	7	3	3	1	3	1
Pots/traps	3	8	1	2	1	0	1
Mobile gear/trawls	1	3	3	3	4	3	4
Longlines	5	6	2	2	3	2	1
Jigs	0	2	1	0	0	0	1
Aquaculture	1	4	1	1	1	0	0

6. Which of the following measures to reduce ALDFG are being used in your region, at local, national, or regional level.

Answer Options	Yes	No	Dont know
Gear marking to indicate ownership	6	3	1
Gear modification to reduce loss	5	4	1
Technical – transponders	1	7	2
Technical – biodegradable gear	4	6	0
Requirements to report losses	5	4	1
Port State measures	2	3	5
Effort regulation (e.g. soak times)	7	2	1
Spatial management regulation	9	0	1
Fishermen education/training	7	1	2
Development of codes of practice/conduct	5	3	2
Port-side collection facilities	8	1	1
Economic incentives (e.g. payment for old gear)	0	10	0
Ex-post clean up/recovery	8	2	0
Recycling	6	2	2

7. How effective do you think the following measures could potentially be, or are, in preventing ALDFG in your region

Answer Options	Very effective	Quite effective	Not very effective
Gear marking to indicate owner-ship	2	5	1
Gear modification to reduce loss	0	7	1
Technical - transponders	2	1	2
Technical - biodegradable gear	3	2	1
Requirements to report losses	4	0	3
Port State measures	2	2	2
Effort regulation (e.g. soak times)	2	2	3
Spatial management regulation	2	5	2
Fishermen education/training	3	4	2
Development of codes of practice/ conduct	0	4	2
Port-side collection facilities	4	4	0
Economic incentives (e.g. payment for old gear)	1	3	2
Ex-post clean up/recovery	4	3	0

8. Do you think the following measures should be legislated for i.e. compulsory, or promoted through voluntary approaches? And at what level do you think they would be most appropriately addressed (you may tick more than one level, but if possible we would prefer you to select different levels for different measures). Please also note that if you suggested particular measures would not be effective in question 16, you could leave the rows relating to those measures blank

Answer Options	Legislated/ mandatory	Voluntary	International	Regional
Gear marking	7	1	4	2
Technical gear modification to reduce loss	3	4	3	2
Technical - transponders	1	5	3	1
Technical - biodegradable gear	2	4	3	5
Requirements to report losses	7	0	3	3
Port State measures	5	0	3	3
Effort regulation (e.g. soak times)	7	0	2	4
Spatial management regulation	7	0	1	5
Fishermen education/training	3	5	2	5
Codes of conduct	2	4	3	5
Port-side collection facilities	4	4	4	2
Economic incentives (e.g. payment for old gear)	1	4	1	2
Other	0	0	1	1
Ex-post clean up/recovery	2	5	1	4
Recycling	2	5	3	2

Appendix D

Breakdown of gear retrieval programme costs

TABLE 11
Cost of the Norwegian gear retrieval survey

Budget item	Cost in Kr.	Cost in €
Boat hire and fuel for one month	1.1 million	133 000
Collecting information (Fishermen's survey)	0.12 million	14 520
Survey labour cost, travel, report writing	0.28 million	33 880
Total cost	**1.5 million**	**181 500**

Source: Brown *et al.,* 2005.

TABLE 12
Estimated costs for deep water pilot retrieval survey

Budget item	Total cost in €
Boat hire 20 days at €5 000 day	100 000
Fishermen's survey (consultant time costs)	15 000
Retrieval gear	15 000
Total	**130 000**

Source: Brown *et al.*, 2005.

TABLE 13
Process and costs of the Baltic retrieval programme conducted by Sweden

Gear retrieval steps	Cost in €
Determine areas of net loss with industry. Based on good communications between industry and researchers.	Labour time of fishermen (2 person days) and scientists (2 person days) to discuss appropriate area for survey. Information collected in advance of planned gear retrieval programmes
Hire retrieval vessel (normal commercial vessel rather than a research vessel. Medium-sized stern trawler with 2 net drums)	10 sea days at > €1 100/day (12 000 Kr./day)[3]. Costs depend on time of year – it is cheaper during the summer cod closure, although earlier times of year are favoured
Determine retrieval gear development costs – suitability varies by region, e.g. Norwegian gear not suitable to Baltic conditions	2 years, 3 people part-time (2 person months)
Purchase retrieval gear, e.g. sweeps, hooks, otter doors (of special size)	Approximately €1 000
Dispose of retrieved gear	Costs borne by port authorities in Sweden and Denmark
Maintain retrieval gear	Dependent on frequency of retrieval work and nets recovered, but generally very low – €100/year
Prepare evaluation	5 person days to evaluate the weight and length of netting, weight and length of fish caught in net. Attempts to look at value v total cost of harvest, but many uncertainties. Could look at trends in nets being caught per retrieval effort (net retrieval per unit of effort (NRPUE))

Source: Brown *et al.,* 2005.

[3] Hire costs in other countries may vary considerably depending on differences in vessels needed, and basic differences in costs for similar items between countries.

Abandoned, lost or otherwise discarded fishing gear (ALDFG) is a problem that is increasingly of concern. This report, undertaken by the United Nations Environment Programme (UNEP) and the Food and Agriculture Organization of the United Nations (FAO), reviews the magnitude and composition of ALDFG, and while noting that information is not comprehensive and does not allow for any global estimates, suggests that gillnets and fishing traps/pots may be the most common type of ALDFG. Factors leading to ALDFG as well as their impacts are presented. The report profiles measures already considered to stem the problem and includes a number of recommendations for future action.

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