

Part IV. Plant Assessment Form

For use with “Criteria for Categorizing Invasive Non-Native Plants that Threaten Wildlands”
by the California Exotic Pest Plant Council and the Southwest Vegetation Management Association

Electronic version, February 28, 2003

Table 1. Species and Evaluator Information

Species name (Latin binomial):	Undaria pinnatifida (Harvey) Suringar
Synonyms:	enter text here
Common names:	Japanese kelp, wakame, Asian seaweed
Evaluation date (mm/dd/yy):	4/7/05
Evaluator #1 Name/Title:	Gina Skurka
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Evaluator #2 Name/Title:	Joseph DiTomaso
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Section below for list committee use—please leave blank

List committee members:	Carla Bossard, John Randall, Carri Piroso, Dan Gluesenkamp, Gina Skurka, Brianna Richardson
Committee review date:	7/8/05
List date:	enter text here
Re-evaluation date(s):	enter text here

General comments on this assessment:

Gina contacted several people but was unable to obtain good information on current rate of spread of California populations.

Table 2. Criteria, Section, and Overall Scores

1.1	Impact on abiotic ecosystem processes	D	Rev'd, Sci. Pub'n
1.2	Impact on plant community	C	Rev'd, Sci. Pub'n
1.3	Impact on higher trophic levels	D	Rev'd, Sci. Pub'n
1.4	Impact on genetic integrity	U	No Information

Impact

Enter four characters from Q1.1-1.4 below:

DCDU

Using matrix, determine score and enter below:

C

2.1	Role of anthropogenic and natural disturbance	B (2 pts)	Rev'd, Sci. Pub'n
2.2	Local rate of spread with no management	B (2 pts)	Other Pub. Mat'l
2.3	Recent trend in total area infested within state	B (2 pts)	Other Pub. Mat'l
2.4	Innate reproductive potential Wksht A	B (2 pts)	Rev'd, Sci. Pub'n
2.5	Potential for human-caused dispersal	A (3 pts)	Rev'd, Sci. Pub'n
2.6	Potential for natural long-distance dispersal	A (3 pts)	Anecdotal
2.7	Other regions invaded	C (1 pt)	Rev'd, Sci. Pub'n

Invasiveness

Enter the sum total of all points for Q2.1-2.7 below:

15

Use matrix to determine score and enter below:

B

Plant Score

Using matrix, determine Overall Score and Alert Status from the three section scores and enter below:

Low

No Alert

3.1	Ecological amplitude/Range	B	Rev'd, Sci. Pub'n
3.2	Distribution/Peak frequency Wksht C	D	Rev'd, Sci. Pub'n

Distribution

Using matrix, determine score and enter below:

C

Table 3. Documentation

<p>Question 1.1 Impact on abiotic ecosystem processes</p>	<p>D Rev'd, Sci. Pub'n back</p>
<p>Identify ecosystem processes impacted: Our three year study of low shore assemblages in a sheltered New Zealand harbour has provided no evidence of significant ecological impacts from invasion of Undaria</p>	
<p>Rationale: enter text here</p>	
<p>Sources of information: Forrest, B.M. and M.D. Taylor. 2002. Assessing invasion impact: survey design considerations and implications for management of an invasive marine plant. <i>Biological Invasions</i>. 4: 375-386.</p>	
<p>Question 1.2 Impact on plant community composition, structure, and interactions</p>	<p>C Rev'd, Sci. Pub'n back</p>
<p>Identify type of impact or alteration: An annual that apparently cannot compete well with large perennial brown algae, and is inhibited from establishing dense populations amongst natural kelp beds. A significant decrease in the surface covered by other species has been observed both in shallow and deeper areas during the period of max development of Undaria. In addition, a recent study provided evidence that indigenous species did not decrease in spring where Undaria was absent. Studies show no evidence of displacement of native algae, but showed that, in Tasmania, Undaria sporophytes established at high densities in plots from which the canopy of native algae was removed. The weight of evidence overall suggested little impact from Undaria on low shore assemblages, with control-impact contrasts that could plausibly be interpreted as impacts probably reflecting natural causes. There was no evidence for displacement of the native canopy by Undaria, with planned contrasts of percent cover between the controls and each of the infested sites largely suggesting a "no impact" result. The increased canopy cover resulting from Undaria's infestation could enhance sub-canopy low shore algal populations by providing greater shelter from dessication at low tide, as has been discussed in other studies.</p>	
<p>Rationale: enter text here</p>	
<p>Sources of information: Edgar, G.J., N.S. Barrett, A.J. Morton, and C.R. Samson. 2004. Effects of algal canopy clearance on plant, fish and macroinvertebrate communities on eastern Tasmanian reefs. <i>J Exp Mar Bio and Eco</i>. 312: 67 - 87.</p> <p>Curiel, D. P. Guidetti, B. Bellemo, M. Scattolin, and M Marzocchi. The introduced alga <i>Undaria pinnatifida</i> in the lagoon of Venice. <i>Hydrobiologia</i>. 477 1 June, 2002. 209-219.</p> <p>Valentine, J.P. and C.R. Johnson. 2004. Establishment of the introduced kelp <i>Undaria pinnatifida</i> following dieback of the native macroalga <i>Phyllospora comosa</i> in Tasmania, Australia. <i>Marine and Freshwater Research</i>, 2004, 55, 223-230.</p> <p>Forrest, B.M. and M.D. Taylor. 2002. Assessing invasion impact: survey design considerations and implications for management of an invasive marine plant. <i>Biological Invasions</i>. 4: 375-386.</p>	
<p>Question 1.3 Impact on higher trophic levels</p>	<p>D Rev'd, Sci. Pub'n back</p>
<p>Identify type of impact or alteration: Our three year study of low shore assemblages in a sheltered New Zealand harbour has provided no evidence of significant ecological impacts from invasion of Undaria.</p> <p>Both Undaria's population dynamics and its effects upon native communities have been found to vary greatly among invaded areas.</p>	

Rationale: enter text here	
Sources of information: Forrest, B.M. and M.D. Taylor. 2002. Assessing invasion impact: survey design considerations and implications for management of an invasive marine plant. Biological Invasions. 4: 375-386.	
Question 1.4 Impact on genetic integrity	U No Information back
Identify impacts: enter text here	
Rationale: enter text here	
Sources of information: enter text here	
Question 2.1 Role of anthropogenic and natural disturbance in establishment	B Rev'd, Sci. Pub'n back
Describe role of disturbance: An annual that apparently cannot compete well with large perennial brown algae, and is inhibited from establishing dense populations amongst natural kelp beds. Undaria exhibited the only pronounced response to canopy removal amongst algal taxa, with a fivefold increase in cleared blocks compared to control blocks. Marine reserves are suggested to assist reef communities resist invasion by Undaria through an indirect mechanism involving increased predation pressure on sea urchins and reduced formation of urchin barrens that are amenable to Undaria propagation. Disturbance events important for successful establishment of Undaria at high densities. In the absence of disturbance to the canopy, stands of native algae resisted development of Undaria sporophytes. Undaria occurs at high densities only in disturbed habitats, particularly on sea urchin barrens and also on areas of sand-scour at the edge of rocky reefs and on unstable substrata, but it occurs rarely in established native algal communities. The results from the present study highlight the opportunistic nature of Undaria. If intense disturbance occurs at an appropriate frequency it can be expected that Undaria will maintain large and persistent populations.	
Rationale: enter text here	
Sources of information: Edgar, G.J., N.S. Barrett, A.J. Morton, and C.R. Samson. 2004. Effects of algal canopy clearance on plant, fish and macroinvertebrate communities on eastern Tasmanian reefs. J Exp Mar Bio and Eco. 312: 67 - 87. Valentine, J.P. and C.R. Johnson. 2004. Establishment of the introduced kelp Undaria pinnatifida following dieback of the native macroalga Phyllospora comosa in Tasmania, Australia. Marine and Freshwater Research, 2004, 55, 223-230.	
Question 2.2 Local rate of spread with no management	B Other Pub. Mat'l back
Describe rate of spread: Eradication project underway in Monterey Bay. Santa Barbara populations had large recruitment pulse in 2002 in conjunction with a drop in ocean temperature, but recruitment was low in 2001.	
Rationale: enter text here	

Sources of information: Von Bubnoff, A. 2005. Seaweed eradication effort working. Monterey Herald. March 14, 2005. Accessed: www.montereyherald.com	
Question 2.3 Recent trend in total area infested within state	B Other Pub. Mat'l back
Describe trend: In CA, Undaria has been reported from at least 6 sites along the coast including Monterey harbor, Santa Barbara harbor, Channel Island harbor (Ventura), Oxnard harbor, Cabrillo Beach (San Pedro), and two coves at Catalina Island.	
Rationale: enter text here	
Sources of information: 2002 Red Alert! New Introductions and Recent Expansions in California. Mandy Tu and John M. Randall. The Nature Conservancy's Wildland Invasive Species Team. John Knapp, Catalina Island Conservatory, Personal communication, April 2005	
Question 2.4 Innate reproductive potential	B Rev'd, Sci. Pub'n back
Describe key reproductive characteristics: An annual. From July to September 2001, there was limited recruitment of new Undaria sporophytes. Experimental manipulations provided evidence of fast re-colonization potential of algae mainly attributable to its efficient reproductive system. After the laterally biflagellate, haploid spores are released, typically swim for up to 5-6 h before settling on a firm substrate, where they develop directly into microscopic, filamentous male and female gametophytes. male gametes fertilize eggs, which then develop in situ into embryonic sporophytes. A single frond releases an astronomical number of zoospores, which appear to settle randomly. Probably all fertilized eggs develop into embryonic sporophytes. If the latter manage to survive grazers, their very rapid growth ensures continued survival unless the spores settle intertidally.	
Rationale: enter text here	
Sources of information: Thornber, C., B. Kinlan, M. Graham, and J. Stachowicz. 2002. Invasive ecology of the Japanese alga Undaria pinnatifida in California (abstract only). Cal-EPPC Symposium 2002, Vol 6, 2000-2002. 2002 Red Alert! New Introductions and Recent Expansions in California. Mandy Tu and John M. Randall. The Nature Conservancy's Wildland Invasive Species Team. Edgar, G.J., N.S. Barrett, A.J. Morton, and C.R. Samson. 2004. Effects of algal canopy clearance on plant, fish and macroinvertebrate communities on eastern Tasmanian reefs. J Exp Mar Bio and Eco. 312: 67 - 87. Curiel, D. P. Guidetti, B. Bellemo, M. Scattolin, and M Marzocchi. The introduced alga Undaria pinnatifida in the lagoon of Venice. Hydrobiologia. 477 1 June, 2002. 209-219. Silva, P.C., R.A. Woodfield, A.N. Cohen, and L.H. Harris, and J.H.R. Goddard. First report of the Asian kelp undaria pinnatifida in the northeastern Pacific Ocean. Biological Invasions 4: 333-338, 2002.	
Question 2.5 Potential for human-caused dispersal	A Rev'd, Sci. Pub'n back
Identify dispersal mechanisms: The initial European introduction of Undaria to Venice has been attributed to the spat importation of the Japanese oyster Crassostrea gigas. Maritime traffic and oysters' cultivation and transport have subsequently favoured its diffusion in the following years. Undaria has been introduced through a combination of intentional transport for cultivation, accidental transport with oysters, as fouling on vessel hulls, and possibly other means. Establishment of large populations of Undaria in CA would almost certainly lead to	

harvesting by Asian immigrants, either for personal or commercial use.	
Rationale: enter text here	
Sources of information: Curiel, D. P. Guidetti, B. Bellemo, M. Scattolin, and M Marzocchi. The introduced alga <i>Undaria pinnatifida</i> in the lagoon of Venice. <i>Hydrobiologia</i> . 477 1 June, 2002. 209-219. Silva, P.C., R.A. Woodfield, A.N. Cohen, and L.H. Harris, and J.H.R. Goddard. First report of the Asian kelp <i>Undaria pinnatifida</i> in the northeastern Pacific Ocean. <i>Biological Invasions</i> 4: 333-338, 2002.	
Question 2.6 Potential for natural long-distance dispersal	A Anecdotal back
Identify dispersal mechanisms: Spores can be moved in the ocean currents for long distances.	
Rationale: enter text here	
Sources of information: enter text here	
Question 2.7 Other regions invaded	C Rev'd, Sci. Pub'n back
Identify other regions: Recently established at several locations in CA coastal waters. Native to Japan, but in recent decades it has spread to coastal areas worldwide. It is already documented as invasive off the coasts of Australia, New Zealand, South America, and Europe, where it has invaded harbors and artificial substrates. It has also been found near Ensenada, Baja California Norte, Mexico. Since its appearance in 1992 in the lagoon of Venice, <i>Undaria</i> has gradually expanded along the banks of canals both at Chioggia and Venice, becoming the dominant species in the local algal community from February to July.	
Rationale: enter text here	
Sources of information: Cal-EPPC Symposium 2002, Vo. 6. 2000-2002. 2002 Red Alert! New Introductions and Recent Expansions in California. Mandy Tu and John M. Randall. The Nature Conservancy's Wildland Invasive Species Team. Curiel, D. P. Guidetti, B. Bellemo, M. Scattolin, and M Marzocchi. The introduced alga <i>Undaria pinnatifida</i> in the lagoon of Venice. <i>Hydrobiologia</i> . 477 1 June, 2002. 209-219. Silva, P.C., R.A. Woodfield, A.N. Cohen, and L.H. Harris, and J.H.R. Goddard. First report of the Asian kelp <i>Undaria pinnatifida</i> in the northeastern Pacific Ocean. <i>Biological Invasions</i> 4: 333-338, 2002.	
Question 3.1 Ecological amplitude/Range	B Rev'd, Sci. Pub'n back
Describe ecological amplitude, identifying date of source information and approximate date of introduction to the state, if known: Recently established at several locations in CA coastal waters. Discovered in Santa Barbara County in April 2001. Will grow on any available firm substrate. Prefer sites that are at least somewhat protected, though they can grow in open coast sites. Growth is not prevented by organic pollution. Water temperatures along the Pacific Coast of the United states are favorable for the establishment of <i>Undaria</i> from at least Baja California to British Columbia. <i>Undaria</i> was discovered in southern California spring of 2000, and by the summer of 2001 had been collected at several CA sites from Los Angeles to Long Beach Harbors and Catalina Island as far north as Monterey Harbor. Sheltered and partially sheltered regions including the Southern	

California Bight, Monterey Bay, the more oceanic parts of San Francisco Bay, Tomales and Humboldt Bays would seem to offer excellent growing conditions.	
Rationale: enter text here	
Sources of information: Cal-EPPC Symposium 2002, Vo. 6. 2000-2002. Silva, P.C., R.A. Woodfield, A.N. Cohen, and L.H. Harris, and J.H.R. Goddard. First report of the Asian kelp <i>ndaria pinnatifida</i> in the northeastern Pacific Ocean. <i>Biological Invasions</i> 4: 333-338, 2002.	
Question 3.2 Distribution/Peak frequency	D Rev'd, Sci. Pub'n back
Describe distribution: New invader, limited distribution so far.	
Rationale: enter text here	
Sources of information: Cal-EPPC Symposium 2002, Vo. 6. 2000-2002. Silva, P.C., R.A. Woodfield, A.N. Cohen, and L.H. Harris, and J.H.R. Goddard. First report of the Asian kelp <i>ndaria pinnatifida</i> in the northeastern Pacific Ocean. <i>Biological Invasions</i> 4: 333-338, 2002.	

Worksheet A[back](#)

Reaches reproductive maturity in 2 years or less	Yes: 1 pt
Dense infestations produce >1,000 viable seed per square meter	Yes: 2 pts
Populations of this species produce seeds every year.	Yes: 1 pt
Seed production sustained over 3 or more months within a population annually	No: 0 pt
Seeds remain viable in soil for three or more years	No: 0 pts
Viable seed produced with <i>both</i> self-pollination and cross-pollination	No: 0 pt
Has quickly spreading vegetative structures (rhizomes, roots, etc.) that may root at nodes	Unknown: 0 pts
Fragments easily and fragments can become established elsewhere	Unknown: 0 pts
Resprouts readily when cut, grazed, or burned	Unknown: 0 pts
	4 pts 3 unknowns
	B (4-5 pts)
Note any related traits: enter text here	

Worksheet C - California Ecological Types

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(*sensu* Holland 1986)

Major Ecological Types	Minor Ecological Types	Code*
Marine Systems	marine systems	D. present
Freshwater and Estuarine Aquatic Systems	lakes, ponds, reservoirs	score
	rivers, streams, canals	score
	estuaries	D. present
Dunes	coastal	score
	desert	score
	interior	score
Scrub and Chaparral	coastal bluff scrub	score
	coastal scrub	score
	Sonoran desert scrub	score
	Mojavean desert scrub (incl. Joshua tree woodland)	score
	Great Basin scrub	score
	chenopod scrub	score
	montane dwarf scrub	score
	Upper Sonoran subshrub scrub	score
	chaparral	score
Grasslands, Vernal Pools, Meadows, and other Herb Communities	coastal prairie	score
	valley and foothill grassland	score
	Great Basin grassland	score
	vernal pool	score
	meadow and seep	score
	alkali playa	score
	pebble plain	score
Bog and Marsh	bog and fen	score
	marsh and swamp	score
Riparian and Bottomland	riparian forest	score
	riparian woodland	score
	riparian scrub (incl. desert washes)	score
Woodland	cismontane woodland	score
	piñon and juniper woodland	score
	Sonoran thorn woodland	score
Forest	broadleaved upland forest	score
	North Coast coniferous forest	score
	closed cone coniferous forest	score
	lower montane coniferous forest	score
	upper montane coniferous forest	score
	subalpine coniferous forest	score
Alpine Habitats	alpine boulder and rock field	score
	alpine dwarf scrub	score

* A. means >50% of type occurrences are invaded; B means >20% to 50%; C. means >5% to 20%; D. means present but ≤5%; U. means unknown (unable to estimate percentage of occurrences invaded).